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THE AMERICAN LUMBER INDUSTRY

EMBRACING THE

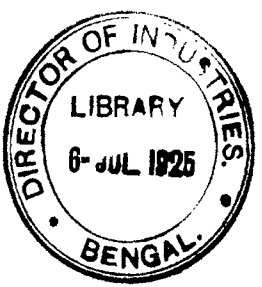
Principal Features of the Resources, Production, Distribution, and Utilization of Lumber in the United States.

BY

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TO

MY MOTHER AND FATHER

IN ACKNOWLEDGMENT OF

KINDLY ENCOURAGEMENT, UNFAILING DEVOTION

AND INSPIRING IDEALISM

THIS VOLUME

IS AFFECTIONATELY DEDICATED

PREFACE

THE American lumber industry is peculiarly lacking in published material on its national phases, whereas there is a great wealth of books and other published material available on the petroleum, textile, cement, steel, coal, and other industries of less importance. A great deal has been written regarding special aspects of the American forests and their utilization, but the entire industry has never heretofore been comprehensively dealt with in one volume.

This book is designed to serve as a textbook in forest schools; as a practical aid for those engaged in the lumber industry; and as a source of reference for the general public interested in national phases of this industry, particularly its economics, statistics and merchandising methods, and the part it plays in our national welfare. It is written from the standpoint of the timber owner, manufacturer, wholesaler and retailer, and therefore embraces the chief features of all these great branches of the industry.

Owing to the breadth of the subject there has been need for brevity in its treatment. The author has purposely abbreviated the chapters on phases of the industry that have had extensive treatment elsewhere, such, for example, as logging, manufacture, preservation, and seasoning, and has expanded those on which relatively little published material is available.

This book is the result of a continuous study made by the author during his fifteen years' connection with the subject—embracing its manufacturing, wholesaling, exporting, and technical phases.

The author is deeply indebted for valuable material to the United States Forest Service, the Bureau of the Census, the Bureau of Foreign and Domestic Commerce, the Federal Trade Commission, the Interstate Commerce Commission, and the United States Tariff Commission. The trade associations and their secretaries have been particularly helpful with new data and illustrative material, especially Mr. John E. Rhodes of the Southern Pine Association, Mr. Robert B. Allen of the West Coast

Lumbermen's Association, Mr. W. W. Schupner of the National-American Wholesale Lumber Association, Mr. A. W. Cooper of the Western Pine Manufacturers' Association, Dr. Wilson Compton of the National Lumber Manufacturers' Association, Mr. Paul S. Collier of the North Eastern Retail Lumber Dealers' Association, Mr. J. M. Pritchard of the Hardwood Manufacturers' Institute and Mr. C. Stowell Smith of the California White Pine Sugar Pine Association. Several of these men have reviewed portions of the text and supplied the author with excellent criticisms and suggestions.

The lumber trade journals, notably the *American Lumberman*, the *Lumber World Review*, the *Hardwood Record*, the *Southern Lumberman*, the *Timberman*, the *West Coast Lumberman*, *Lumber Trade Journal of New Orleans*, *Lumber*, and the *New York Lumber Trade Journal*, have been freely consulted; and from their columns much valuable material has been used.

The author is exceedingly grateful, for many helpful suggestions, comments, and reviews, to Mr. George S. Long of Tacoma, Mr. Charles S. Keith of Kansas City, Mr. Charles W. Hill of New York City, Mr. Charles N. Perrin of Buffalo, Mr. Axel H. Oxholm of Washington, D. C., Mr. Chester J. Hogue of Seattle and New York City, the Weyerhaeuser Sales Organization at Spokane and St. Paul, the Ritter Lumber Company organization, Professor A. B. Recknagel of Ithaca, Mr. H. B. Coho of New York City, Mr. John R. Walker of New York City, Mr. Raphael Zon of Washington, D. C., Mr. Thomas McCann of Minneapolis, Mr. H. D. Tiemann of Madison, Wisconsin, and many others who have commented on various parts of the text.

To my colleagues of the faculty of the New York State College of Forestry at Syracuse University, particularly Dean Moon, Professor H. L. Henderson, and Professor R. J. Hoyle, and several students who have been most helpful, I am exceedingly grateful for their kind interest and stimulating suggestions.

There is appended a selected bibliography of valuable works, to which the author has had recourse in the preparation of this book, and which may be consulted by those desiring a more elaborate treatment of particular phases of the industry.

NELSON COURTLANDT BROWN.

July, 1923.

FOREWORD

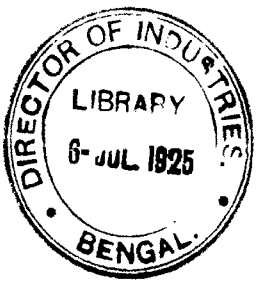
THE American lumber industry has passed through its pioneer development stages and has come to play, more than ever, a vital part in the economic life and welfare of the American nation. It has been demonstrated that the best interests of the lumber industry and of all our people lie along the same path of constructive accomplishment. The raw material of the lumber industry consists of the only natural resource of which the supply and the depleted areas are plainly visible. It is the only natural resource which nature, if unhindered, will reproduce.

Consequently, as depletion progresses, urged on by the myriad demands for lumber, the lumbermen themselves and the public in general are more and more concerned with the great part the industry is playing in our national development.

This has given rise to a widespread inquiry for a comprehensive treatise dealing with the lumber industry in a broad national way. The author of this book is peculiarly fitted to supply this demand, by reason of his experience as a practical lumberman, and his later, more academic training as a professor of Forest Utilization in the New York State College of Forestry. I am confident that this work will go far toward accomplishing the desirable result of bringing the public and the industry to a better understanding of their mutual interests.

JOHN W. BLODGETT,
President, National Lumber Manufacturers' Association.

GRAND RAPIDS, MICHIGAN,
June, 1923.



INTRODUCTION

ECONOMIC forces have made lumber manufacture the pioneer and nomad among American industries. Its characteristics have been drawn from the undeveloped wilderness and the rugged forces of nature. The quest for fresh supplies of standing timber, presenting their wide range of physical problems, has given the industry much of the spirit of the explorer, of the man who constantly takes chances in pitting his brains and resourcefulness against natural obstacles. The lumber industry has the ruggedness and buoyancy of primitive, frontier conditions. It has been a tremendous dynamic force, with almost unlimited energy and resourcefulness, confidently pushing out as the vanguard of civilization beyond the ranges and the plains.

To-day the conditions in the lumber business of the United States are rapidly changing. The last ranges have been crossed. The last great virgin fields of timber have been entered. The industry must, to a considerable extent, retravel its old paths. It must get down to small things. It must utilize stumpage, of a different kind and far more costly than the virgin timber which hitherto has fed its mills. Alike in manufacturing and in merchandising, it must become a business governed by more exact specifications, by closer attention to details, and by the small economies which determine the success of business in a more stable and intensified economic order. In continuing the vast economic service which it has hitherto rendered, the lumber business is faced with many adjustments to the new conditions of timber supply and transportation and the closer inter-relations between the sawmill and the users of its products which necessity is now bringing about. Evolution and change are bound to be more rapid than during any previous period in its life. And a more effective adjustment of the business to its present conditions must replace many of the old traditions and ideas which hitherto have driven the wandering and impetuous sawmills forward on their course.

The most important question which confronts the lumber industry to-day is its future source of raw material. This industry shares with

the entire country the problems created by the depletion of our virgin forests. Its future depends upon substituting a stable supply of timber for the temporary and disappearing one which it has previously enjoyed. Logging appliances, manufacturing equipment, and merchandising hitherto have largely engrossed the thought and skill of the lumberman. A self-perpetuating source of raw material now demands its place as one of the major problems and opportunities for initiative in the business.

It will be the crowning accomplishment of an industry whose energy and resourcefulness have long commanded admiration, if some measure of the same driving power which has overcome other great obstacles in the past can be directed against the shortage of raw material now looming plainly in sight. It will be a wonderful thing if the lumber industry can cooperate with the public in a solution of our reforestation needs which will minimize the issue of public necessity versus individual interest, so common in economic problems. And to the extent that the lumber industry contributes to a real solution of reforestation, it will create stability and permanence for itself.

From all of these standpoints, both the lumbermen themselves and the consuming public whom they serve need to know more about this great business, about its methods and processes, and about the distribution and merchandising of the wares of the sawmill in their vast range of public and trade relationships. To the extent that all of these things are better understood and their progressive developments more clearly defined, every one concerned with the manufacture and use of timber will be better equipped to meet intelligently the needs of the middle decades of the twentieth century. I feel sure that Professor Brown's book will fill a useful place in interpreting the lumber industry to those engaged in it and to those concerned in its future service to the American people.

COLONEL WILLIAM BUCKHOUT GREELEY,
Chief, United States Forest Service.

April 30, 1923.

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AMERICAN LUMBER INDUSTRY

CHAPTER I

GENERAL

IMPORTANCE

THE American lumber industry, measured by its traditions, its size and effect on national welfare, and as a means of furnishing a livelihood to large numbers of people, is in many ways the greatest and most typical American industry.

The business of converting a great natural resource in virgin forests into materials for housing a growing population and for supplying its structural and other requirements necessarily has been of great importance in the up-building of this nation. Shelter, next to food, is the most important necessity of mankind. The American nation has always been committed to the use of wood and it is likely to continue this custom, which has been handed down by centuries of tradition, as long as it is economically possible to do so. The demands on our forests have been increasing rather than diminishing. Substitutes have been introduced to serve some of the purposes formerly filled by wood, but despite the increased use of concrete, steel, iron, brick, patented shingles, etc., new processes in both chemical and mechanical lines of utilization, which mean an ever-increasing demand upon our forests, are constantly being devised.

Every single American industry is dependent upon the forest for lumber or other products. If the commodity itself, as produced in our various industries, is not wholly or partly made of wood, it is shipped in wooden containers or it must use wooden cars, rolling over wooden ties, or be shipped in wooden vessels. Our lives are irrevocably and intimately associated with lumber and related forest products.

Intense competition and hazardous employment of large investments have attended the conversion of round trees, growing in remote forests in

difficult and inaccessible locations, to the shapes and forms demanded by the consumer, whether for home-building purposes, for the manufacture of furniture, for car construction, for the ship-building industry or for other multitudinous uses, such as automobiles, agricultural machinery, boxes, and crating, cross ties, bridge timbers, flooring, poles and piling, doors and sash, etc.

The business of manufacturing and distributing lumber is one of the most important in this country and, with the cutting of our remaining virgin forests and the concurrent advance in prices for all forms of forest products, the significance of this great resource will become more and more apparent to the American public.

As a result of the relatively cheap and abundant supply of building materials throughout the development stages of this nation, a larger percentage of families live in and own separate houses than in any other country in the world. Lumber is cheaper in the United States, in spite of comparatively high wages and short working hours, than in any other country.

The very foundation of American civilization is centered about the home. The production of abundant and inexpensive supplies of lumber has made possible the housing of this nation, during its relatively short history of one hundred and fifty years, in separate homes wherein the traditions, ideals, and strength of the country have been largely nurtured and crystallized.

DISTINCTIVE FEATURES OF THE INDUSTRY

The outstanding facts in connection with the American lumber industry and the affiliated forest and woodworking industries may be summarized as follows:

1. They employ over a million men. Over five million people are directly dependent for their livelihood upon these industries. It has been estimated that with all the distributing agencies, associated industries, transportation, etc., more than one-tenth of our total population is dependent upon the forest which, next to agriculture, is our greatest single resource.

2. These industries represent an investment of over $15,000,000,000. A considerable portion of the total available capital of this country, recently estimated at 17 per cent, is tied up in standing forests, logging equipment and railways, sawmills, woodworking industries, lumber stocks, etc.

3. The transportation lines of the United States derive a greater revenue from lumber and associated forest products than from any other commodity. The yearly railroad freight bill is over $170,000,000 for lumber, etc., amounting to over 200,000,000 tons, representing more than 10 per cent of the total tonnage of the railroads.

4. The lumber industry is the oldest and most typical American industry and probably affects the life of the nation more intimately than any other industry, except agriculture.

5. We produce more than one-half of the total lumber cut of the world, yet we only export 5 to 7 per cent of our annual production. Our lumber industry is more highly developed, to meet a greater variety of sizes and species, conditions of logging and manufacture and distribution, than that of any other country.



FIG. 1.—A group of representative hickories in Putnam Co., Tennessee. (Courtesy of U. S. Forest Service.)

6. There are over six hundred different species of trees found in the United States, of which over sixty are of considerable commercial importance. The cross currents of merchandising these varieties of lumber are most complex and serve to stimulate the keenest and most intense competition in both our domestic and foreign markets.

7. The principal lumber production since 1890 has been in the Southern States, but the great remaining bodies of virgin timber are on the West Coast, particularly in the five northwestern states of Oregon, Washington, California, Idaho, and Montana, in order of importance. This region will be the great center of future supplies.

8. The great centers of lumber consumption are in the congested centers of population, such as the states of New York, Illinois, Pennsylvania, Michigan and Ohio, together with the New England States. The problems of distribution, transportation and of competition will

therefore increase greatly with the shifting in the great producing centers.

9. Lumber is largely produced at great manufacturing plants requiring heavy investments of capital and cutting from 100,000 to 1,000,000 board feet per day. There are over 30,000 sawmills in the United States. The tendency has been to increase the size of the producing units, and this will continue until our virgin forests are finally cut off, after which the small manufacturing unit will increase in importance.

10. The logging of American forests and the manufacture of lumber have been accompanied by tremendous losses of wood in the past. Only a relatively small percentage—from 33 to 36 per cent of the wood content—of the trees cut is utilized. Abundant forests, relatively low stumpage values, and high transportation costs, combined with the demands of the public for only the better grades, and other exigencies of the economic situation, have been largely responsible for this condition.

HISTORICAL OUTLINE

The production of materials for shelter has been intimately associated with the entire development and economic life of this nation. From the time of the first landing of the early Colonial settlers in Virginia and Massachusetts, the lumber industry has not only been an essential and important one, but one in which the traditions and romance of the up-building of a great nation have been associated in an important and interesting way.

Records are somewhat conflicting regarding the early days of the lumber industry; but spars and ship timbers, as well as lumber, were among the first products of the early settlers even before tobacco and other agricultural products were shipped from this country.

The first sawmill existing in the early days of this country has been reported at Jamestown, Virginia, in 1625. It is also claimed that the first sawmill was located at Berwick, Maine, in 1631. These early sawmills were an adaptation of the type used in Europe, with the old familiar water wheel and a single sash-saw cutting slowly and producing only a few hundred board feet per day. The first sawmill known in history was erected in Central Italy about the year 1550, with a single sash-saw driven by water power, and is still operating at this time. Early American sawmills were of the same type. For a long period these primitive mills were an unimportant factor in production; timbers were hewn,

shingles were split and boards were whip-sawed by hand labor. This continued without further developments in the water-wheel type of manufacture until the introduction of steam, in the early decades of the nineteenth century, gave a great impetus to mechanical lumber manufacture. This was a very necessary concomitant in the growth of this nation, as our population began to increase with great strides and bounds shortly after the introduction of steam as a motive power in transportation and manufacture.

As our colonies grew in size and the land along the Atlantic seaboard began to be thickly populated, the people pushed westward over the Alleghanies and through the Mohawk, Ohio, and other valleys into the fertile regions of the Central West.

For a long time after the earliest colonial period and until 1850, Maine held the leadership as the principal lumber-producing state in this nation. The "Pine Tree State," became a great center in the world's trade in white pine spars, staves, etc., while Virginia shipped great quantities of oak and the Southern States developed a trade in yellow pine and naval stores from the great pineries in that region.

In 1850, with the cutting of the more accessible forests in Maine, the industry shifted to New York, and many Maine lumbermen with their families moved "west," to New York and purchased timber limits from holders of early colonial grants. In those early days Albany developed rapidly as a great distributing center.

Toward the latter part of the nineteenth century, the population of this country increased rapidly. In 1850, there were 8,000,000,000 board feet of lumber manufactured, and New York with its Adirondack section was the leading lumber state in the Union, producing 20 per cent of the country's production.

Then with the rapid cutting of the best and most accessible timber along the available driving streams and the necessity for increased production to meet the ever-increasing population, the center of the lumber industry moved south to Pennsylvania, which in 1860 was the leading lumber-producing state with its great forests of virgin white pine. The hemlock was usually left standing or cut for tanning purposes alone. In 1870, there was a shift to the great "cork," white pine forests of Michigan. Those splendid virgin forests frequently had an early sale value of only $1.00 per acre and an acre commonly contained from 10,000 to 40,000 board feet of timber.

The introduction and rapid extension of logging railways to tap the more remote forests aided very materially in increasing the volume of

production. These railways have largely replaced river driving and now are the chief method of transporting logs to the mills.

In 1880, the industry spread to Wisconsin and then to the Southern States, with the yellow pine replacing the white pine as the important building lumber of the country. Since 1895 southern yellow pine has supplied from 20 to 40 per cent of the total lumber cut of the country, and more lumber has been produced in the South and Southeast than in any other section. This region will continue to be an important source

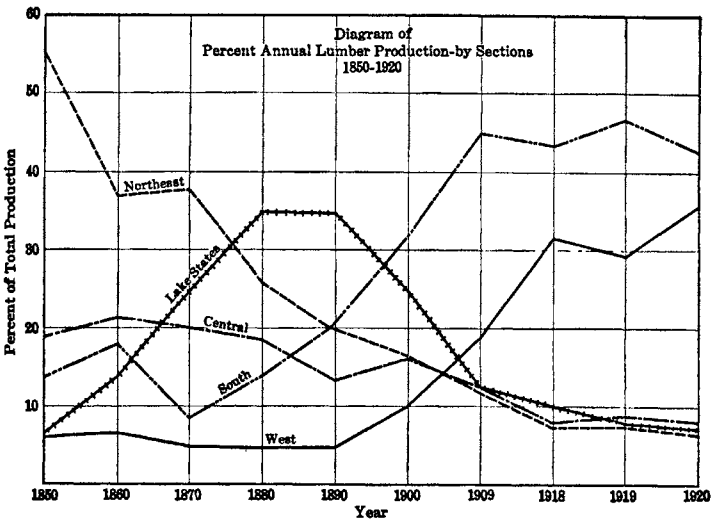


FIG. 2.—This shows the progressive development of the lumber industry for 70 years to 1920, with the rapid falling off of percentage production in the East, the rise and fall of the Lake States as an important producing center, the rise of the South since 1870 and its continuance for 25 years as the great source of supplies and the rapid advance in the position of the West Coast region.

of lumber for several years. The peak of lumber production in the Lake States was reached in 1892.

In 1900, Washington and Oregon began to assume relatively large importance in the lumber production of the country, and at the present time the industry is moving from the Southern States as a center of the country's lumber supply to the far Northwestern States.

Many American families prominent in the lumber industry can be traced from the early generations in Maine, New York, and Pennsylvania to Michigan and Wisconsin and thence to various locations in the

South and Far West. In many instances, representatives of the same lumber families are now found in both the West and the South.

With the expansion of the industry there has been a marked change in the species of lumber produced. For a long time white pine occupied the premier position in lumber production, but, with the shifting of the industry to the South, yellow pine assumed the dominant position and such species as hemlock, spruce, red gum, and a great variety of hardwoods, which had formerly been ignored, came into prominence. Still later came a rapid advance in the production of Douglas fir in the Northwest.

With the changes in species production and the tremendous increase in volume production, came refinements in the organization of the industry itself. From 1890 to 1900, great advances were made in grading and classifying lumber to benefit both producer and consumer. Associations of manufacturers, wholesalers, retailers, and exporters, organized for the exchange of ideas and mutual assistance, came into existence, particularly in the period between 1900 and 1910.

From 1910 to 1920, there came into existence, within the industry, a new consciousness of its relations to the Government and to the public. Largely through the activities of the prominent manufacturers' associations, the Federal Government and the public at large have been consulted and taken into the confidence of the industry. Policies of frankness, open discussions and the publication of facts and figures have displaced the former secret methods, fear of the Government, legal entanglements and distrust of public attitude. This change of sentiment has had a most salutary influence on the industry itself as well as on the public estimate of the lumber business.

During the World War the industry responded with characteristic patriotism to the demands of the great emergency. A central bureau was voluntarily set up, with autocratic authority to marshal the resources of the industry for the great ship-building program, the erection of cantonments, etc., at prices fixed by the Government. A study, by the Federal Trade Commission, of war-time costs and profits of 143 southern pine companies showed an average return on the investments of 9 per cent in 1918 and about 8½ per cent in 1919.

More recent developments in the industry have been distinguished by the following outstanding features:

1. A greater interest in forestry and the future timber supplies for the industry—induced both by an interest in the general welfare of the future of the country and by economic necessity.

2. Standardization of the lumber product in sizes and nomenclature to better fit the needs of the consumer and the structural requirements of the country.

3. A higher standard of business ethics in the handling, marketing and distribution of lumber, chiefly in the arbitration of disputes, acceptance of responsible inspection, observance of stated or implied trade customs, etc.

4. A desire for better technical knowledge of the physical, mechanical and chemical properties of wood, as applied to seasoning, selling, handling, and the utility and limitations of each species of lumber.

DEFINITIONS AND EXPLANATIONS

Lumber.

The terms descriptive of various sizes and shapes of lumber and timber have been loosely applied in the industry. The following definitions have been adopted by the Interstate Commerce Commission and by a committee of the industry, and were recently promulgated for general adoption throughout the industry.

I. *Use Classification:*

Lumber is the product of the saw and planing mill, not further manufactured than by sawing, resawing, and passing lengthwise through a standard planing machine, crosscut to length, and matched.

Lumber is classified as (1) yard lumber, (2) shop or factory lumber, and (3) structural timber. Different grading rules apply to each class of lumber.

(1) Yard lumber is lumber that is less than 6 inches in thickness and is intened for general building and construction purposes. The grading of yard lumber is based upon the use of the entire piece.

(2) Shop or factory lumber is lumber intended to be cut up for use in further manufacture. It is graded on the basis of the percentage of the area which will produce a limited number of cuttings of a given minimum size and quality.

(3) Structural timber is lumber that is 6 inches or over in thickness and width. The grading of structural timber is based upon the strength of the piece and the use of the entire piece.

Yard lumber is classified roughly as (*a*) finish and (*b*) construction lumber. There is no sharp line between finish and construction lumber. The medium grades may be used for either purpose.

(*a*) Finish is yard lumber of the higher grades, in which appearance, perfection of the surface, and finishing qualities are primarily the basis on which the grade is determined. The higher finishing grades are more suitable for "natural," or transparent finishes while the lower finishing grades are smooth and free from serious defects and are particularly adapted to the use of paint.

(*b*) Construction lumber is yard lumber which is graded primarily upon the basis of its strength, as affected by defects, and its fitness for general construction purposes.

II. *Size Classification:*

(1) Strips are yard lumber less than 2 inches thick and under 8 inches wide. Strips are usually manufactured into matched and patterned lumber.

(2) Boards are yard lumber less than 2 inches thick and 8 inches or over in width.

(3) Dimension includes all yard lumber except boards and strips and timbers; that is, yard lumber 2 inches and under 6 inches thick and of any width.

(*a*) Planks are yard lumber 2 inches and under 4 inches thick and 8 inches and over in width.

(*b*) Scantlings are yard lumber 2 inches and under 6 inches thick and under 8 inches wide.

(*c*) Heavy joists are yard lumber that is 4 inches and under 6 inches thick and 8 inches or over wide.

(4) Timbers are lumber 6 inches or larger in their least dimension.

Hardwoods and Softwoods.

These are commonly accepted trade distinctions and not a classification of hardness. The term softwoods includes all the so-called conifers or evergreens, such as the pines, spruces, firs, larches, cypresses, cedars, hemlocks, junipers and redwoods. Of this group, the larches and southern cypress drop their leaves in winter and hence are not evergreen. The term hardwoods comprises all the others, sometimes referred to as the broad-leaved species, such as the oaks, ashes, hickories, maples, gums,

basswoods, chestnut, poplars, birches, elms, beech, etc. All these hardwoods drop their leaves in winter, except a few evergreen oaks. There are thirty-five different pines and forty-eight different oaks in this country.

Some softwoods, such as longleaf yellow pine, Douglas fir, western larch, etc., are very much harder than some of the hardwoods, among the softer varieties of which may be mentioned basswood, chestnut, yellow poplar, cottonwood, etc. Generally speaking, however, the hardwoods are much harder, heavier, stronger, and tougher than the softwoods and consequently their utilization is more specialized than that of the softwoods which find their greatest utility in general construction, building, and housing purposes.

Terms, Abbreviations, and Synonyms.

There are a great many terms and abbreviations employed in the lumber industry. Those most frequently used on invoices, stock sheets, and letters are the following:

AD	Air-dried
BM	Board measure
CIF	Cost, insurance and freight
CIFE	Cost, insurance, freight, and exchange
Clg	Ceiling
CMCB1S	Center matched and center beaded one side
D&H	Dressed and headed
D&M (T&G)	Dressed and matched (tongued and grooved)
D4S or S4S	Dressed four sides, also D1S, etc.
D1S1E	Dressed one side, one edge
E&CB	Edge and center beaded
E&CB1S	Edge and center beaded one side
E&CB2S	Edge and center beaded two sides
EG or VG	Edge grain or vertical grain, quarter-sawed, comb grain, rift (all synonyms)
EM	End matched
FAS	Free alongside (term used in water movement), i.e., within reach of ships' tackles
FAS	Best grade of hardwood, i.e., firsts and seconds.
FG or SG	Flat grain-plain sawed-bastard sawn-slash grain (synonyms)
Flg	Flooring

F.O.B.	Free on board
FOK	Free of knots
F.O.R.	Free of railway
F.O.T.	Free on trucks
F.O.W.	First open water (referring to shipments made through ports closed part of year on account of ice)
G	Green
GCC	Gulf coast classification (used in exporting southern pine)
HBk	Hollow-backed (board)
KD	Kiln-dried
KD saps	Kiln-dried saps
LCL	Less than carload lots
M	1000
MBF	1000 board feet
MW	Mixed widths
Merch.	Timber that is merchantable, also a grade of southern yellow pine and export Douglas fir
Mldg	Molding
O.G.	Oval groove
OM	Outside measure
Pcs.	Pieces
RE	Round edge (used chiefly in New England)
Rgh	Rough
RL&W	Random widths and lengths
Sel. Struc.	Select structural, the name of a grade of southern yellow pine
S&E	Side and edge
SF	Superficial feet—same as board feet
S/Lap or SL	Shiplap
SM	Surface measure
Sdg.	Siding
SND	Sap no defeect
Std.	Standard (refers to dressing, grade or foreign measure)
S_4SCS	Surfaced 4 sides with calking seam on each edge (refers to ship decking)
SSE	Sound and square edged (applied to grade of hardwood and yellow pine timbers)

S_2S_2E	Surfaced 2 sides and 2 edges (same as S_4S)
TB&S	Top, bottom, and sides (in box industry)
U/S	Unsorted grade in European markets.
Dressed, Finished, *Worked*, *Planed*	Synonyms
′	Usual sign to indicate feet in length
″	Usual sign to indicate inches

4/4, 5/4, 6/4, 8/4, etc., indicating thicknesses of 1 inch, 1¼ inches, 1½ inches, 2 inches, etc.

SCIENTIFIC AND TRADE NOMENCLATURE

Many of the trade names used in manufacturing and distributing American lumber are exceedingly confusing. This confusion is sometimes capitalized for the benefit of certain distributors of lumber, and the ignorance of the buyer is thus played upon to the seller's advantage.

Every species of tree has its scientific name which has originated in certain botanical distinctions. In the final analysis this is often the best means of distinguishing these woods. The common and scientific names of the principal species are shown later in the table of lumber production.

The general tendency within recent years has been towards a common acceptance of one trade name. It is only natural, however, for individual manufacturing or wholesale firms to put a distinctive or local name on their product. For example, western soft pine (*Pinus ponderosa*) is variously called California white pine, Oregon white pine, or Arizona white pine, depending upon the state of its origin. It is also locally called bull pine, western yellow pine, Des Chutes pine, Montana white pine, and western white pine. It is all cut from one species, but the tree produces a different character of growth in various regions of the West, depending upon altitude, precipitation, character of the soil, size, etc. It is the most widely distributed conifer in America. It grows to its largest size in the Sierra Mountains of California but is also produced in excellent quality in central and eastern Oregon, eastern Washington, Idaho and western Montana. Its texture is soft and it is very similar to eastern white pine being used for the same purposes with good effect.

The eastern white pine (*Pinus strobus*) for several centuries was the leading lumber tree of the country and has been called cork pine, Michigan pine, Minnesota pine, northern pine and eastern pine. In England

it is called yellow pine and Canadian pine. The sugar pine of California (*Pinus lambertiana*) and the Idaho white pine (*Pinus monticola*) of northern Idaho and western Montana exhibit the same technical properties as the eastern white pine which is now produced chiefly in Minnesota. All are used for similar purposes, particularly for interior trim, moldings, sash, doors, blinds, high-grade boxing and crating, and general finishing purposes.

Southern pine is locally called many different names in various markets, such, for example, as hard pine, Georgia pine, pitch pine, yellow pine, etc. All these names are applied to longleaf (*Pinus palustris*) shortleaf (*Pinus echinata*) loblolly (*Pinus taeda*) and Cuban or slash pine (*Pinus heterophylla*), all of which are classed together as southern pine. Longleaf is the most prominent and valuable southern pine and loblolly the least valuable. Shortleaf pine is generally sold at a lower price; but for many purposes, such as sheathing and light dimension, it is fully as valuable. Arkansas soft pine comes from shortleaf pine and has earned an enviable reputation for its softness and workability, competing successfully with white pine.

North Carolina pine is made up largely of shortleaf and some loblolly pine and is produced chiefly in Virginia, the Carolinas and Georgia. It is widely used throughout the Northeast and as far west as central Ohio.

Douglas fir has been variously called Washington fir, red fir, yellow fir, Oregon pine, British Columbia fir, etc., but the name Douglas fir is now commonly accepted and used in this country by lumbermen, foresters, botanists and consumers. In Europe, it is commonly called Oregon pine.

Red gum is often merchandised under a number of trade names. Both red gum and sap gum come from the same tree. Red gum is called satin walnut and sap gum is called hazel pine in Europe.

The terms larch, tamarack, and hackmatack are different names applied to the same tree.

Standardization means the adoption of uniform nomenclature as well as uniform sizes and grades. By the adoption of standardized names, the lumber industry can improve its use of nomenclature as applied to different woods and make its products more readily understood and appreciated by the American public.

TECHNICAL PROPERTIES OF WOOD[1]

General Principles.

The physical and chemical properties of each kind of wood, often referred to as the technical properties, determine its usefulness and desirability, other factors, such as cost and availability, being equal. Species vary greatly in their rate of growth, percentage of heartwood and of sapwood, resinous qualities, density, hardness, durability, fiber length, etc., and there are variations in these qualities even within the same species. Wood is a very complex material, and, even after long years of usage, comparatively little is known of its exact technical properties and the possibilities of utilization.

Other materials, such as iron, steel, concrete, asbestos, petroleum, etc., are quite homogeneous, and their factors of safety and other properties can be readily determined. It may be safely stated with reference to wood that no two trees grow exactly alike even within the same species. The number, location, and character of defects, width of grain, etc., differ with every board. Wood is an exceedingly variable material and consequently requires much study and investigation to determine its limits of usefulness.

Some woods are hard, heavy, and durable, and consequently make good cross ties; such, for example, are white oak, longleaf yellow pine, and Douglas fir. Others, like spruce, are free from resin, have long fibers and are desirable for wood pulp and paper. The light and durable white cedar, southern red cedar, and chestnut make excellent material for poles and posts; longleaf pine and Douglas fir are suitable for structural material on account of their strength, and are in great demand for mill construction, heavy bridge work, construction work, flooring, etc. Black locust is peculiarly qualified for use as insulator pins. Maple is exceedingly hard and makes an excellent flooring material. Red gum has rich, distinctive, and pleasing grain and is valuable for furniture, interior finish, cabinet work, etc. Each wood has certain qualifications and properties which make it particularly well adapted for certain purposes. Sapwood is desirable in certain woods, as in hickory for handles, whereas heartwood is desirable in most woods.

The following are some of the more important and fundamental technical properties of wood.

[1] For other properties and an elaboration of this subject see Record's "Economic Woods of the United States" and "Mechanical Properties of Wood," John Wiley & Sons, New York.

Sapwood and Heartwood.

Trees grow by laying on a new ring of wood each year during the growing season, which lasts from spring to late summer or early fall. The lighter-colored layer inside the bark is commonly called sapwood and is made up of live cells. Inside the sapwood is the heart, or heartwood, which is usually darker in color and is physically dead. The moisture content of the heartwood is less than that of the sapwood. Sapwood is usually wide in young trees and gradually turns into heartwood as the tree grows older. The proportion of heartwood is thus greater in old trees than in young ones. Heartwood is generally more durable, heavier, harder, and stronger than the sapwood, and seasons better. The distinction between the two is important in many phases of the lumber industry, especially in grading.

Heartwood comes from the heart of the same tree which produces sapwood, but the younger trees yield a wider growth of sapwood. The particular grade known on the Gulf Coast as kiln-dried saps comes from the sapwood of longleaf and shortleaf yellow pine.

It is the highly colored heartwood of the redwood, persimmon, red birch, walnut, black locust, and red gum which largely gives them their high value and desirability on the markets. All of these trees yield sapwood, but it is generally considered inferior and is discriminated against in the trade. Sapwood, however, is generally more susceptible to impregnation by preservatives—a factor which is exceedingly important in the cross-tie and timber-preservation industry.

Sap hickory has been demanded in the trade for handle and tool stock, but it has not been proved to be in any way superior for practical purposes to the reddish heartwood. This trade prejudice has given rise to the enormous wastage in our valuable and rapidly vanishing hickory. The sapwood of maple makes better flooring and is considered more desirable than the heartwood. In many species, such as hemlock and basswood, there is very little difference in appearance, and no distinction is made in the trade between the value of heartwood and sapwood in these and similar species. In North Carolina pine, white pine, western soft pine, and Idaho white pine no distinction is made between the heartwood and the sapwood. In some woods like southern pine, North Carolina pine, sap gum, etc., the sapwood is highly susceptible to discoloration due to blue stain.

Second-growth trees of all species have relatively more sapwood than our virgin trees; consequently in the future the question of the amount of sapwood will be still more important.

Springwood and Summerwood.

Trees grow most rapidly in the spring, after their winter dormancy. The new spring growth consists of large, thin-walled cells, whereas the summer season produces small, thick-walled cells. From one-third to one-half of the season's total growth, or ring, is commonly laid on during the first three to six weeks, out of a total growing season of some twenty to thirty weeks. In the North, the growing season is much shorter than in the South, but northern species frequently grow as fast as those found in the South, the relation between springwood and summerwood remaining about the same. In the tropics the growing season is the entire year, so that there is no distinction between springwood and summerwood.

As a result of the quick growth in the early growing period of each annual ring, springwood is light in weight and color, weak, soft, and non-durable, as compared with the heavier, harder, denser summerwood. This is particularly noticeable in southern pine, Douglas fir, spruce, etc. In some so-called ring-porous woods, such as oak, ash, chestnut, elm and hickory, the springwood is distinguished by large pores or wood cells. In other woods, such as maple, birch, beech, basswood, dogwood, red gum, etc., there is little difference between springwood and summerwood. These are called diffuse-porous woods, as the pores are diffused and scattered throughout the season's growth, irrespective of the time of its formation. Most of the softwoods, such as pine, fir, spruce, hemlock, cedar, and redwood, are non-porous; that is, they do not have the large, open pores or holes such as are found in the hardwoods. The large, open pores in the springwood of red oak render this wood less valuable for cooperage purposes and for liquid-containers than white oak in which the springwood has small and numerous pores, rendered water-tight by tyloses, a growth within the pores.

The relative amounts of springwood or summerwood determine the density of a given piece of wood. This fact is the basis of the density rule as applied to southern pine and Douglas fir. (See chapter on Grading Rules for further explanation.)

Moisture and Shrinkage.

A large percentage of the weight of green wood, usually from 45 to 70 per cent, is due to the presence of water. The loss of moisture, which takes place in seasoning, adds strength, stiffness, hardness and durability to all woods. The absorption of moisture after seasoning results in an expansion of the fibers and a consequent swelling, warping or twisting.

Shrinkage takes place during the seasoning of all woods, the amount varying with the species, and the dryness and shape of the particular piece of lumber.

The denser, heavier, and harder woods, including most of the hardwoods, shrink more than pines, cedars, firs or spruces.

Wood shrinks more in width and thickness than in length. It shrinks less along the quarter grain than along the flat grain. Tangential shrinkage varies from 1.2 to almost 3.5 times as much as radial shrinkage. Quarter-sawed or edge-grained lumber therefore shrinks less in seasoning than flat-sawed stock.

As the structure of hardwoods is more complicated than that of softwoods, the process of seasoning is very important in the case of the former. Considerable warping, twisting, checking, and honey-combing are likely to take place during the elimination of the moisture. The more rapid the drying or seasoning the greater is the likelihood that defects will appear in the dried lumber. A more extensive treatment of this general subject will be found in the chapter on Seasoning.

Weight or Specific Gravity.

The weight of wood is of great importance, as it determines the transportation cost from mill to consumer. Different woods vary greatly in weight, and often within the same species there is considerable latitude.

In the trade, weight is usually expressed in pounds per thousand board feet. It is also expressed in specific gravity, or the relation between the weight of a given volume of wood and that of the same volume of water. A cubic foot of water weighs 62.5 pounds. The specific gravity of white pine, which weighs slightly more than one-third as much as water, is .36. Specific gravity is used in technical and scientific discussions. The weight of both softwoods and hardwoods is generally expressed in pounds per thousand board feet.

Durability.

The durability of wood is its ability to resist decay. This property is of exceedingly great importance, as many forms of lumber in final placement are exposed to decay. The inherent qualities of wood determine its durability and therefore its utilization and value, unless it is treated to lengthen its life in service.

In truth, all forms of wood, unless protected from the weather, are

subject to fungus attacks, commonly called decay or rot. Flooring, furniture, interior trim and numerous other forms of wood do not generally decay, but timbers used for rail construction or for bridge work, cross ties, and exterior finish of all kinds are highly susceptible to fungus attacks on account of their exposed situation.

Decay is responsible for 90 per cent of the replacements of all forms of wood. It may occur in standing trees, either living or dead, or may develop during or after the process of seasoning. Blue stain, or "bluing," is a form of fungus commonly occurring on pine lumber and some other varieties.

There seems to be no correlation between strength, rate of growth, toughness, etc., and durability. Hickory, one of our toughest and hardest trees, is exceedingly perishable when exposed to the elements, as when in or on the surface of the ground or exposed to the weather. The cedars, cypress, and redwood, which are among the softest and weakest of woods structurally, are, on the other hand, among the most durable. They are consequently in great demand for exterior finish and work which will be exposed to the weather. For some unexplained reason, the white oaks are more durable than the red oaks. Moreover, there is no general distinction between the durability of hardwoods and that of softwoods.

Sapwood is much less durable than heartwood of the same species, but the difference is greater in some woods than in others. Summerwood is much more durable than springwood. Generally speaking, dark-colored hearts and woods with large quantities of resin, tannin, etc., are durable. Redwood, black locust, chestnut, persimmon, and western red cedar are exceedingly durable but not resinous. Cypress, which has a dark heartwood, longleaf pine, and Douglas fir are very resinous and durable.

The following table illustrates the relative durability of the principal commercial species. It is based upon comparison with the durability of white oak.

RELATIVE DURABILITY (RESISTANCE TO DECAY) OF UNTREATED WOODS

Durability of commercial white oak taken as 100 per cent. (From U. S. Forest Service.)

Conifers or Softwoods

Cedar, eastern red (juniper)	150–200
Cedar, southern white	80–100
Cedar, other species	125–175
Cypress, bald	125–175
Douglas fir (dense)	75–100
Douglas fir, (average mill run)	75– 85
Fir (the true firs)	25– 35
Hemlock	35– 55
Larch, western	75– 85
Pine, jack	35– 45
Pine, longleaf, slash (Cuban)	75–100
Pine, Norway	45– 60
Pine, pitch, sugar	45– 55
Pine, shortleaf	60– 80
Pine, southern yellow (dense)	80–100
Pine, western white	65– 80
Pine, white	70– 90
Pine, western yellow, pond, loblolly, lodgepole	35– 50
Redwood	125–175
Spruce, Englemann, red, Sitka, white	35– 50
Tamarack	75– 85
Yew, Pacific (western)	170 plus

Hardwoods

Ash	40– 55
Aspen	25– 35
Basswood	30– 40
Beech	40– 50
Birch	35– 50
Butternut	50– 70
Catalpa	125–175
Chestnut	100–120
Cottonwood	30– 40
Elder, pale	25– 35
Elm, cork (rock), slippery	65– 75
Elm, white	50– 70
Gum, black, cotton (tupelo)	30– 50
Gum, red	65– 75
Hickory	40– 55
Locust, black	150–250
Locust, honey	80–100
Magnolia, evergreen	40– 50
Osage orange	200–300

Spiral Grain.

Instead of extending straight up the tree, vertically parallel to the pith, the grain of some species often grows in spiral fashion around the pith. This is likely to occur in all species, and is serious only in connec-

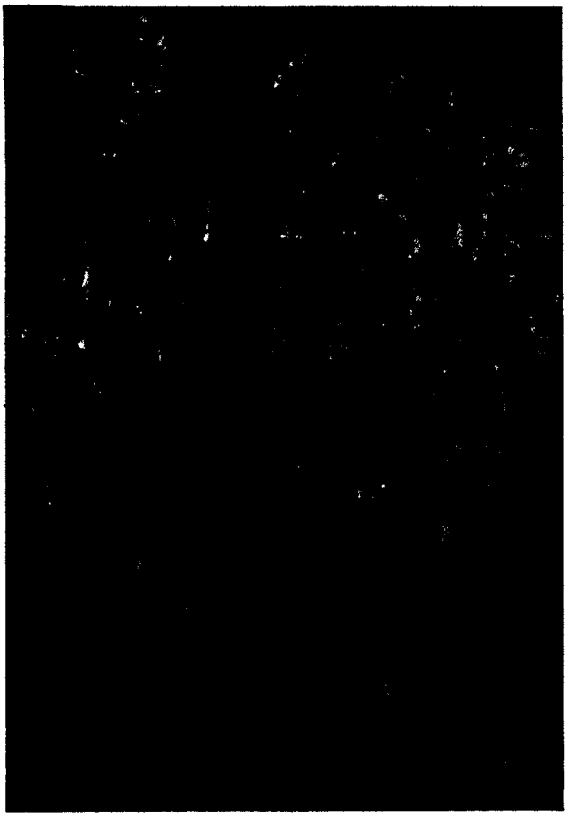


FIG. 3.—Typical cypress forest in the swamps of Southern Louisiana. Cypress is one of our most valuable trees.

tion with structural timbers, dimension, and boards, as it causes them to check or open up, resulting in wastage or decreased strength.

Although most trees grow with a fairly straight grain, in actual practice it is difficult to saw lumber with edges and sides parallel to the grain. It is absolutely necessary to do so in the case of wing beams, struts, and

other parts of aeroplanes and important in the case of structural timbers.

The reason for the occurrence of spiral grain has never been thoroughly understood or explained, but some trees apparently have an inherent tendency to grow in spiral fashion. This is very noticeable in forests that have been culled or burned. After the bark has dropped off and the white surface of the wood oxidizes in contact with the air, visible checks frequently occur. In fact, in many forests of this character it is seldom that one finds perfectly straight-grained trees.

In making shakes (split shingles), split staves for tight cooperage, and for other purposes, spiral grain results in considerable loss of good wood, in addition to the losses in the manufacture of lumber.

Degrading due to spiral grain is not apparent until the stock has seasoned.

ADVANTAGES OF WOOD CONSTRUCTION

Wood is the most economical and universally used construction material. From the earliest historic times until the present, it has been used in a greater variety of ways than any other material, not only for building and structural purposes but for the arts and industries and for decorative purposes as well.

Briefly analyzed, the advantages of wood construction may be summarized as follows:

1. In proportion to its weight, wood is the strongest known material.
2. Wood is the most workable material and lends itself readily to manufacture into many shapes and designs.
3. Wood is a non-conductor of heat, thus helping to make homes warm in winter and cool in summer.
4. Its grain and appearance are generally attractive and render it readily susceptible to artistic treatment, thus adding to the beauty and attractiveness of furniture, finish, trim, etc.
5. Wood is comparatively inexpensive as a construction material, and if used with care and without undue waste will be available for many years at a reasonably low cost.
6. Wood is abundantly available in so many different kinds, shapes, sizes, and forms that it is suitable for practically all purposes.

The following table shows the costs of a typical single-family, frame dwelling compared with a dwelling of the same size, constructed of other materials.

Frame with wood siding	$4080
Frame with cement stucco on wood lath	4177
Frame with cement stucco on metal lath	4213
Stucco on hollow tile	4627
Common brick (solid)	4717
Common brick with face brick front	5007

The following table shows the comparative cost of exterior construction as between lumber and other materials, exclusive of labor costs:

Type.	Cost.	Increase over Frame with Wood Siding. Per Cent.	Percentage of Total Building Cost. Per Cent.
Frame with wood siding	$656	.....	16
Frame with cement stucco on wood lath	709	8	17
Frame with cement stucco on metal lath	745	14	18
Stucco on hollow tile	1064	62	23
Common brick (solid)	1186	81	25
Common brick with face brick front	1436	119	29

Aside from its many advantages as a construction material, lumber is regarded, both by financial institutions and by transportation companies in foreign as well as domestic trade, as a desirable commodity. Thus, original ocean or railway bills of lading or other evidences of ownership of lumber in transit are readily recognized by banks as sufficient security on which to advance funds in connection with other documents.

Lumber is a staple, well-known product of wide utility and demand, and its principal advantages from the viewpoint of the banker, railway, ocean freight line or those undertaking the risks of delivery and payment, are as follows:

(1) It does not deteriorate in value if properly handled and cared for.
(2) It is not affected by changing styles or whims of the public.
(3) It has a prompt resale value.
(4) Heat, cold, or climatic changes do not readily affect it.
(5) On account of its weight and bulk, it is not easily stolen.
(6) It can be readily insured at a relatively low rate.

FORESTRY AND THE LUMBER INDUSTRY

Within recent years, the subject of forestry, with especial reference to the growing of future timber supplies with which to support the industry, has become one of the most important subjects of discussion in conventions of lumbermen, as well as in the lumber trade journals. It is very apparent that the timber supplies in the Northwest, representing the last available virgin source of material for the industry, will be exhausted within a comparatively short period of time. After that the industry must resort to second growth entirely.

In the light of the experience of Europe, where the virgin supplies were removed from two hundred to one thousand years ago, a better system of forestry will have to be practiced in this country. The Chief of the United States Forest Service has estimated that, with the present 470 million acres of potential forest land available for growing timber in the United States, the equivalent of 27 billion cubic feet can be produced annually from this area. This figure is 5 billion cubic feet over the present annual consumption of all forms of forest products.

A national forest policy for the country has been broadly discussed not only within the industry and within professional forestry circles, but also before Congress, before the meetings of the United States Chamber of Commerce and those of many other organizations, both public and private, which are interested in the future economic welfare of the country. The conservation of forest resources is recognized as one of the most important problems bearing on the future welfare and stability of the country; and although it may be many years before an ultimate form is adopted, it is reasonable to believe that, within a comparatively few years, a solution will be reached that will be agreeable to the owners of private timber land, representing about 75 per cent of the total forest area of the country, as well as to the general public, who are recognized as having a direct interest in the business on account of its influence and effect on the general welfare.

CHAPTER II

FORESTS

ORIGINAL FORESTS

It has been estimated by the Forest Service that the original forests of this country covered 822,000,000 acres. This represented nearly one-half of the total surface of the country, which is estimated to be about 1,900,000,000 acres. The original forests stretched unbroken from the Atlantic to the treeless prairies of the Central West, and appeared again on the higher slopes of the Rocky Mountains.

West of the crest of the Cascade and Sierra Nevada Mountains are located the most valuable, heavy, and dense forests to be found in the world. They are particularly dense in western Oregon, and western Washington. The original virgin forest of the United States is estimated to have contained 5,200,000,000,000 board feet of timber, and was the most varied, valuable and useful forest found in any country in the world.

PRESENT STAND

The present stand of timber in this country is estimated to be 2,215,000,000,000 board feet. The remaining forest area is estimated to be 463,000,000 acres, of which only about 130,000,000 acres are virgin forests.

Over one-half of the remaining volume of timber lies in the Pacific Northwest, in the following states, in order of importance: Oregon, Washington, California, Idaho, Montana. About 61 per cent is found west of the Great Plains.

About 20 per cent of our remaining timber is composed of the hardwoods, chief of which are oak, red gum, beech, birch, maple, and tupelo.

The following table shows the remaining timber resources by species, as estimated by the Forest Service:

STANDS OF SAW TIMBER IN THE UNITED STATES, BY SPECIES

(Quantities in million board feet, lumber tally)

Species.	Total.
Eastern hardwoods	459,675
Oak	157,372
Birch, beech, maple	90,784
Red gum	44,222
Chestnut	19,319
Hickory	15,784
Cottonwood and aspen	10,824
Ash	9,988
Yellow poplar	9,611
Others	101,771
Eastern softwoods	391,046
Southern yellow pine	257,691
Hemlock	30,896
Spruce and fir	31,572
Cypress	22,921
White and Norway pine	23,457
Others	24,509
Western softwoods	1,364,172
Douglas fir	595,505
Western yellow pine and Jeffrey pine	249,578
Western hemlock	95,092
True firs	91,349
Redwood	72,208
Western white pine and sugar pine	57,071
Western red cedar	53,348
Lodgepole pine	43,919
Spruce	39,822
Others	66,280

ORIGINAL AND PRESENT AREAS OF FOREST IN THE UNITED STATES

Region.	Original.	Present.	
		Total.	Virgin.
	Acres.	Acres.	Acres.
New England	38,908,000	24,708,000	2,000,000
Middle Atlantic	69,610,000	28,678,000	1,896,000
Lake	103,680,000	57,100,000	10,100,000
Central	170,560,000	56,682,000	7,150,000
South Atlantic and East Gulf	170,240,000	99,000,000	18,300,000
Lower Mississippi	128,400,000	78,865,000	20,835,000
Rocky Mountain	63,720,000	60,842,000	37,746,000
Pacific Coast	77,120,000	57,586,000	39,369,000
Total	822,238,000	463,461,000	137,396,000

Various estimates of the remaining resources of this country have been made during the past fifty years, both by the Government and by private companies and individuals. They have generally proved to be low and have not taken in the factor of growth for future cutting.

Estimating our annual consumption of wood in all forms at 100,000,000,000 board feet, and without taking into consideration the factor of growth, our remaining timber resources will roughly last about twenty-five years. If more intensive forestry is practiced and cut-over areas are left in such shape that they will reproduce properly, any contemplated critical period in timber shortage will be averted. After our virgin timber supplies have been removed our forest products will cost what it costs to produce them, as in the case of Europe, as this country cannot look to the tropical regions to supply our structural timbers or our requirements for general building and industrial purposes.

OWNERSHIP

About 75 per cent of the area of our American forests are in private hands and 25 per cent are so-called public forests and are contained in such areas as the National Forests, National Parks, Indian reservations and state forests and parks. It is estimated that two hundred and fifty large companies own or control about one-half of the remaining privately owned timber of this country.

TREE GROWTH

The factor of growth is seldom taken into consideration in the lumber industry. It is a significant fact that timber estimates of the remaining stands left available in our virgin forests, made by various well-known and accepted authorities acting for the Government and in private capacities, have usually been low. Some forests, notably those of Douglas fir and white pine, have been known to grow at the rate of 1000 board feet per acre per year.

Trees lay on an annual ring each year and there is a sharp distinction, in some woods between these annual layers. Some woods, such as virgin redwood and spruce, grow exceedingly slowly, redwoods having been known to continue growing from four thousand to five thousand years. In most species the life of a tree is seldom more than eight hundred to one thousand years. Whether they be conifers, which generally retain their leaves throughout the winter season, or hardwoods, which generally lose them in the fall, all trees are dormant in the winter.

The growth of trees is sure to be given greater consideration in the future in the American lumber industry. In the older sections of New England and the East, particularly in Maine and Massachusetts, second and third cuts are being made on the same areas. It is said that among the wood lots of Massachusetts the forests are growing faster than they are being cut. In the North Carolina pine section, many logging operations are now in progress on timber growing on lands which were cultivated fields during the Civil War.

The attention of lumbermen and foresters has already been called to notable examples of remarkable rates of second growth in Douglas fir and redwood sprout forests. Redwood and pitch pine (*Pinus rigida*) are the only softwoods which sprout, whereas practically all hardwoods send out sprout shoots after cutting.

BENEFITS AND FUNCTIONS OF THE FOREST

Although lumber is generally understood to be the great product of the American forest, there are a great many others to which the attention of the public is being brought more and more. Among these may be mentioned the following:

Wood.

Aside from the enormous quantities of lumber required for construction, housing, and car-building and the multitudinous other uses, from

130,000,000 to 150,000,000 cross ties are annually required for American railroads. Over 6,000,000 cords of pulpwood are required for paper

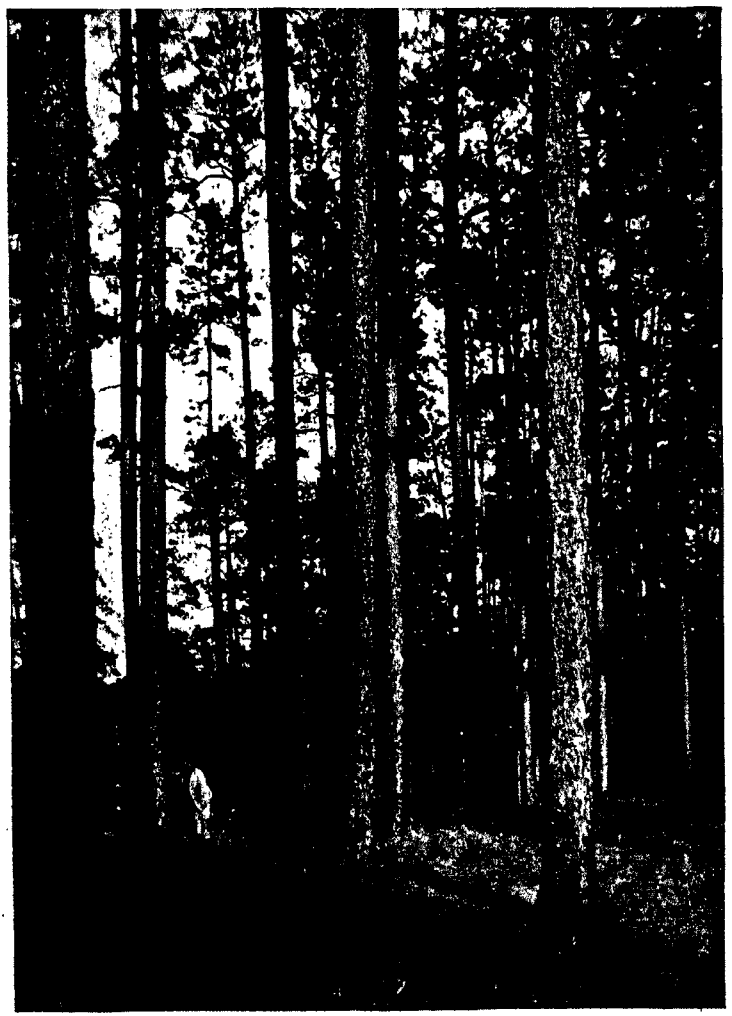


FIG. 4.—A representative stand of longleaf yellow pine in the South. Longleaf and other Southern pines supply the bulk of the country's lumber requirements.

and vast quantities of poles, piling, logs for veneers, cooperage stock, fuelwood and other wood products are taken annually from our forests.

Recreation and Health.

With the advent and almost universal use of motor vehicles, supplementing other forms of transportation, millions are now using and enjoying the forests, in both nearby and remote regions, for these very important purposes. The recreational value of our forests is claiming an increasing share of the attention of the American public.

Water Storage.

The forest plays an exceedingly valuable part in gathering and retaining precipitation for:

(*a*) Municipal supplies of potable water.
(*b*) Water power in industrial sections.
(*c*) Irrigation supplies—of vast importance in the West.

Forage.

Under proper restrictions, forage may be used for cattle, horses, sheep and goat pasturage. This is of great importance in the West and South. In one year, the Forest Service receipts for grazing privileges on the National Forests amounted to about $3,000,000. An important part of our meat supply is produced on our National Forests and on the virgin and cut-over lands of the southern pineries.

Fish and Game.

The forest is the home of game and of fresh-water fish. Many millions of dollars worth of food supplies, as well as a great source of pleasure, are furnished by this important resource.

Prevention of Erosion and Floods.

Millions of dollars' worth of damage are annually caused by the complete removal of the forest cover, in many parts of the country. Especially in regions of steep topography, this damage reaches vast proportions. The Government has recognized the effect of denuded slopes on the navigability of streams, and planting and greater care of forests on the headwaters of streams is in progress in the East.

Beauty of Landscape and Scenery.

Although this cannot be measured in terms of material value, its importance is undeniable, as the attractiveness and interest of any

given region often depends largely upon the character and appearance of the forest cover.

Amelioration of Extremes of Climate.

The forest performs a beneficent service in lessening the rigor of winter and in making the heat of summer less oppressive.

STUMPAGE VALUES

Although our forests have been steadily depleted, particularly within recent years, rising values of lumber on our markets have not been reflected directly in rising stumpage values. In other words, stumpage values react very slowly to lumber market conditions.

Perhaps the greatest rise in stumpage values has been shown in white pine. In the period of 1880 to 1890, considerable white pine stumpage could be purchased for $1 per acre, or in some cases for 5 cents to 10 cents per thousand board feet. These values rose gradually to approximately $1 per thousand board feet, and at the present time well-located virgin stumpage in the Lake States is worth from $10 to $20 or more, per thousand board feet. Second-growth white pine in wood lots in Massachusetts has been sold for from $8 to $15 per thousand board feet.

Southern yellow pine stumpage values still remain comparatively low compared with the rising cost of lumber values. Many of the southern pine operators rate their stumpage as being worth $5 to $9 per thousand board feet. On the west coast, Douglas fir, hemlock, cedar, and pine stumpage is still sold at low levels. In 1922, sales of good commercial stands have been made at $3.50 to $4 per thousand board feet.

The risks attendant upon holding forests for some time before cutting, particularly the risk of fire, together with the business hazards of logging, manufacturing, and placing the product upon the market and the rapid fluctuations of the market value of lumber, have prevented a more widespread speculation, or investment in standing timber. The more accessible and attractive properties were quickly purchased and in many cases have been held over a long period of years, but there have been large areas of the more inaccessible and remote "logging chances" which have not attracted investments by operating companies and, generally speaking, have been of such considerable area and importance that they have adversely affected the rise in stumpage

values which normally might be expected. During the past ten years or more, large timber areas, at fairly reasonable stumpage prices have

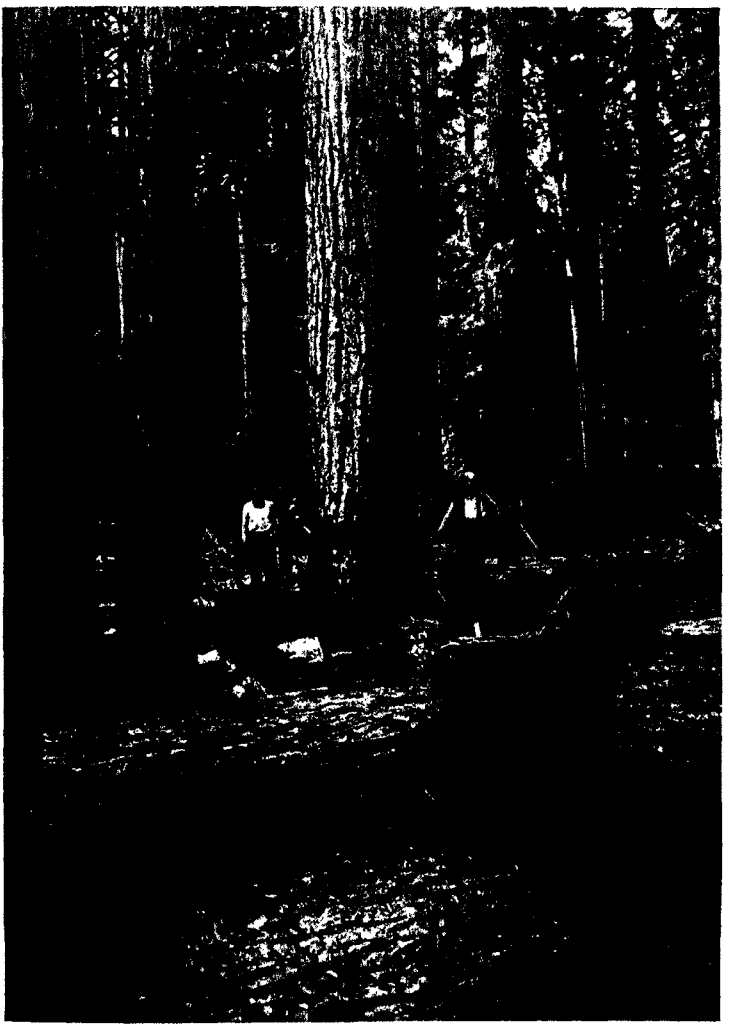


FIG. 5.—Heavy, dense stands of Douglas fir, hemlock, cedar, etc., of the Pacific Northwest in the process of falling and bucking.

been placed on the market but have been sold with considerable difficulty.

TIMBER VALUATION FOR INCOME TAX DETERMINATION

The determination of income-tax liability under the Federal Revenue Acts involves, under certain conditions, the establishment of the fair market value of timber or timberlands. The amount of tax for which an individual or corporation is liable in a given year depends on the amount of net income, which is determined by subtracting from the gross income in that year certain deductions defined by law. These deductions include an allowance for depletion of timber equal to the stumpage value of the timber cut during the year. This stumpage value is based on cost if the timber was acquired after February 28, 1913, or on the fair market value as at March 1, 1913, if acquired prior to that date. Therefore, the timber now being cut which has not changed ownership on or after March 1, 1913, must be valued as of that date. Even cost determination often involves an appraisal, as when timber is acquired for stock without a definitely ascertainable market value, in which case the stock takes the value of the property for which it was issued. Profit from the sale of timberland which was owned on March 1, 1913, also depends on the fair market value at that date. Other conditions arise requiring valuation at other dates, but in any case the kind of value sought is the fair market value of the property as a whole at the date in question.

The same principles govern the appraisal of fair market value for income tax as for any other purpose in which the value sought is the selling price, assuming a transfer between a willing seller and a willing buyer at the particular date and on ordinary terms. By ordinary terms is meant payment in cash, or a substantial first payment with deferred payments from three to five years at ordinary interest. This excludes prices that would be reached in transfers under contracts giving unusually favorable terms, or providing for payment as the timber is cut on a stumpage, acreage, or partial payment plan, without interest on deferred payments. Such factors as character and quality of timber, quantity per acre, and accessibility are important. The chief difficulty involved is that such an appraisal is retrospective and requires careful study and ample data to reconstruct the point of view of a buyer or seller of timber on March 1, 1913, or other basic data, and the conditions existent at that time. It is proper to use all knowledge relating to the quantity and quality of timber which has been acquired since the basic date, but the subsequent changes in conditions, such as the development of common carrier transportation, changes in the

lumber market and in degree of utilization, must be disregarded except in so far as such changes were generally foreseen and recognized in the prices paid for timber prior to the basic date.

The procedure in valuation in connection with the income tax is for the taxpayer to set up the value claimed on its books. When this value is used as a basis for determining tax liability the income tax return must be accompanied by a Forest Industries Questionnaire or Schedule, setting forth this value and the facts upon which it is based. The value thus set up is subject to approval or revision by the Commissioner of Internal Revenue, acting with the assistance of the Timber Section of the Natural Resources Division, a body of forest valuation engineers. If differences arise, the burden of proof is on the taxpayer to show that the value claimed is fair and reasonable.

CHAPTER III

LOGGING

METHODS[1]

In the early days of the lumber industry the logging of our forests was a comparatively simple and inexpensive process. For a long time, in the North, trees were felled in the fall and winter, and hauled out on sleds as long as the snow lasted; in the spring came the old familiar drives to the sawmills, located at the mouths of the rivers or at principal market centers. The building of the nations, homes and structures required so much lumber that the most available forests were rapidly cut off, with the result that at the present time our remaining forests are chiefly composed of large-sized trees growing in comparatively remote and inaccessible locations. The logging of these forests and the transportation of the logs to the sawmills have required methods differing vastly from those in any other part of the world. Even in this country there are many different methods employed in bringing the logs from the forests to the sawmills.

Great changes and improvements have characterized the logging of our forests during the past ten to fifteen years. There has been a rapid change from the use of horses, mules and oxen for transporting logs in the South, and from snow logging in the North, to the use of railroads to tap forests growing in distant locations. Steam logging has also made remarkable progress, particularly in the big timber of the Pacific States and in the South. The advent of the automobile and tractor, for hauling logs from the woods, has brought about great changes, particularly during the period since the War.

Great improvements in camps and living conditions have also characterized the logging of our American forests. In the early days, log camps with straw bunks and very poor accommodations were common throughout our forests. These have been replaced to a large extent by car camps and board camps on railway operations throughout the

[1] For a detailed treatment of the subject of Logging, see "Logging" by R. C. Bryant, John Wiley & Sons, New York City.

country, and by better food and sanitary conditions. This is particularly true in the Northwest, where many camps now have individual iron beds and shower baths, and labor is employed for only eight hours both in the woods and at the mills. In the South much greater attention has been paid to the social and physical conditions under which the negro worker and his family live.

The usual methods of converting standing trees into logs of a size to be economically transported, and at the same time fit in with the



FIG. 6.—Sawyers starting to fall a longleaf pine tree that has been tapped for resin. Steam skidder in the background.

market demands, are generally the same in all of the principal forest regions of the country.

First, the tree is felled, by means of undercutting with an axe on one side and by use of a cross-cut saw to complete the operation. During the past ten years vast improvements have been made in reducing the height of the stump, in which the best lumber is usually contained. On the West Coast, however, trees are still felled from spring boards.

After felling, the bole of the tree is bucked up into suitable lengths, usually 16 feet in all parts of the country, except in the Northwest where logs are usually cut 24 to 40 feet in length and often in tree lengths,

and in portions of the South where tree lengths are sometimes brought directly to the mill.

The logs are next skidded by horses or oxen or by power. Overhead skidding, ground-line skidding and high-lead skidding practiced in the Northwest have been the means of making great improvements in the mechanical hauling of logs from where they have been bucked to the nearest point of the railroad.

On the other hand, snow hauling is largely done by means of tractors or steam log-haulers as they have been found to be much more economical, in the Northeast and the Lake States, than horses.

The use of logging railways has made tremendous advances during the past twenty-five years. In the State of Washington there are said to be over 350 separate and distinct logging railways, and many of these have distinct branch lines.

The use of flumes, rafts, and river driving and the employment of chutes or slides are very uncommon except in restricted localities. In some cases flumes or chutes are found to be the most economical methods of transporting logs from the forest to some other form of transportation or directly to the mill, but their use is exceedingly limited and is becoming less important from time to time, whereas the use of steam skidding and logging railways is increasing rapidly.

COSTS AND ACCOUNTING

A prominent lumber manufacturer has stated that probably not over 1 per cent of the loggers and lumber manufacturers of this country have any real conception of the principles and advantages of cost accounting. In the early days of the industry, when competition was less keen, profits were almost certain. More recently, however, lumber companies have been forced to adopt more scientific methods of cost-keeping. Cost accounting has been shown in many lumber operations to be the difference between guesswork and a knowledge of the facts, and very often has meant the difference between success and failure.

The lumber industry has been exceedingly slow in installing methods of cost accounting in contrast to other great American industries, particularly the steel industry and the other basic manufactures. The Interstate Commerce Commission compels the railroads to use a uniform cost accounting system.

An accurate determination of costs is fundamentally related to operating efficiency, and within the past five years more and more con-

cerns are coming to adopt at least a rough or simple system. The initiative has been taken generally by lumber manufacturers' associations in the installing of cost-accounting systems, but the retail associations have been equally active in showing beneficial results to retail distributors. Cost accounting has also entered the ranks of the wholesaler, but is, no doubt, most needed and gives the best results on logging and lumber manufacturing operations.



FIG. 7.—Bucking a fallen tree into 16-foot log lengths on a western soft pine operation. (Photographed by U. S. Forest Service.)

Many individuals have felt that no system of cost accounting could be flexible enough to be applied to more than one operation, while still others have felt that it would be necessary to increase the overhead charges, in many cases already burdensome, in order to install such a system. It is generally agreed among lumber manufacturers and loggers that too much guesswork has been used in the past.

Our large logging and manufacturing operations have grown to such size that personal supervision is impracticable and often impossible. Therefore, the only way in which the head of an organization

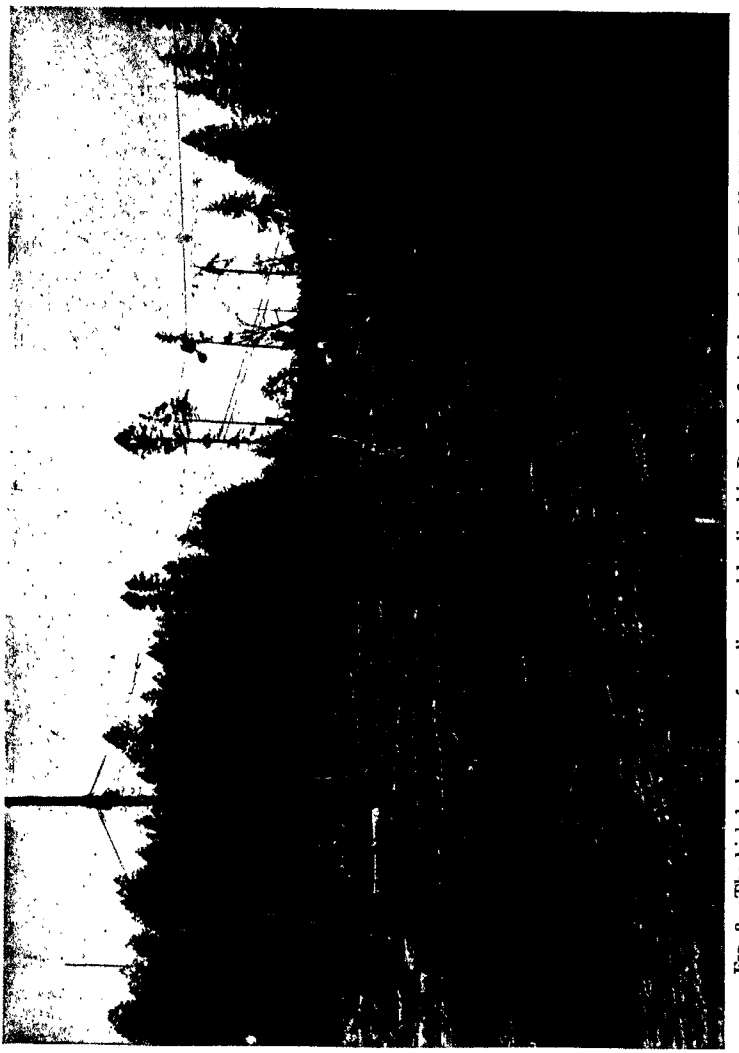


FIG. 8.—The high lead system of yarding and loading big Douglas fir timbers in the Pacific Northwest.

can check up on the efficiency of an operation is by a system of periodical statistical reports, which can only be obtained and compared, one with another, when a proper cost system is in operation. The really important feature in uniform cost systems is the advantage of comparisons with similar periods in the past.

The lack of proper cost information often causes loggers and manufacturers to make unprofitable selling prices, whereas the operator who actually knows his costs is induced to make prices which will show a margin of profit.

Lumber associations are constantly compiling accurate cost data and cost statistics for their members, among the loggers, manufacturers and retailers. Members of these associations really give their data, on the assumption that their competitors are doing the same; that the information is wholly confidential, and that the average statistics will be of benefit to themselves as well as to the industry.

Depreciation is one of the most important overhead expenditures because it is generally the largest, and many cost-accounting systems have been negligent in properly computing or determining the factors of depreciation. On some operations, when profits have been highly satisfactory, a large charge is made against depreciation, whereas, under conditions of minimum profit or loss, a small charge against this factor is made. This method is to be strongly condemned. In other cases, at the close of an accounting period, equipment is given a valuation which is theoretically sound but practically impossible to put into effect. The best way of figuring depreciation is to estimate the scrap value of a piece of machinery or equipment and deduct this figure from the original cost; then apply the balance evenly against the estimated life of the machinery or equipment, so that there is a per-thousand foot charge representing the actual depreciation.

Another method of cost accounting is to keep track of the results obtained per man-hour in the various branches of logging or transportation.

The accompanying diagram shows a common form of the cost-accounting systems, which have proved to be such a valuable asset to the more progressive lumber companies of the country they that are being rapidly installed by the associations among their members and by individual concerns throughout the more important lumber-producing sections.

The following shows the costs of stumpage, logging, and manufacturing of southern yellow pine for the month of February, 1923, during

SOUTHERN PINE ASSOCIATION

No. .....

Uniform Statement of Logs Stock Accounts Month..... 19.....

Subscriber..... Address.....

A—LOGS AT STUMP—(Showing Cost of Logs Produced and Used and Inventories at this point).

Line No.	DESCRIPTION	CHARGES								CREDITS							
		FEET			AVERAGE		AMOUNT			FEET			AVERAGE		AMOUNT		
A																	
1	Stumpage									"Based on cut in woods"							
2	Expenses									"Cruising and Scouring" "Felling, Cutting and Scaling."							
3	Cost this month									Total Lines 1 and 2							
4	Purchased and/or Sold																
5	Inventories																
6																	
7	Logs forwarded Line 8	xx	xx	xx	xx	xx	xx	xx	xx								
8	TOTALS																
B—LOGS AT LOADING POINT—(Showing Cost of Produced and Used and Inventories at this point)																	
9	Logs forwarded Line 7																
10	Expenses									"Hauling to skidder or loader"							
11	Cost this month									Total Lines 9 and 10							
12	Purchased and/or Sold																
13	Inventories																
14																	
15	Logs forwarded Line 37	xx	xx	xx	xx	xx	xx	xx	xx								
16	TOTALS																
C—LOGS IN TRANSIT—(Loaded awaiting Transportation or in Water)—(Showing Cost of Logs Produced and Used and Inventories at this point)																	
17	Logs forwarded Line 16																
18	Expenses									"Loading" and/or "Skidding and hauling"							
19	Cost this month									Total Lines 17 and 18							
20	Purchased and/or Sold																
21	Inventories																
22																	
23	Logs forwarded Line 25	xx	xx	xx	xx	xx	xx	xx	xx								
24	TOTALS																
D—LOGS IN MILL POND OR YARD—(Showing Cost of Logs Produced and Used and Inventories at this point)																	
25	Logs forwarded Line 24																
26	Expenses									"Spur tracks" and all transportation accounts							
27	Cost this month									Total Lines 25 and 26							
28	Purchased and/or Sold																
29	Inventories																
30																	
31	Cost of Logs used by Mill	xx	xx	xx	xx	xx	xx	xx	xx								
32	TOTALS																

SUMMARY OF LOG INVENTORIES	Line	AT FIRST OF MONTH								AT END OF MONTH							
33 At Stump	6																
34 At Loading Point	13																
35 In transit	21																
36 In Mill Pond or Yard	29																
37 As per Cost Sheet																	

NOTE—On Lines 6, 13, 29, 29 Inventory Logs purchased under "Charges" or Logs sold under "credits" at point where delivered is allowed. Ledger accounts for logging expenses should be closed monthly into accounts indicated above as A, B, C and D, including "Camp Expenses, Net" and "Miscellaneous Logging Expenses."

FIG. 9.—Form issued by the Southern Pine Association for reporting logs stock accounts.

which 290,964,285 board feet were produced by a number of mills of this association.

Stumpage, including purchased logs	$5.61
Cost of logs delivered at sawmill	5.94
Sawmilling	5.55
Overhead charges	2.67
Depreciation	1.31
Shipping and selling	1.71
Total cost, including stumpage	$22.79

COST OF LOGGING DOUGLAS FIR—YEAR 1922

48 Operations

Logging Costs	12 Months Ending December 31, 1922		
	M Feet Log Scale	Total Amount	Per M.B.F.
Contract logging	84,611	$ 104,918.18	$ 1.24
Rigging ahead	789,707	189,529.62	.24
Falling and bucking	1,381,987	1,810,402.70	1.31
Yarding and loading	1,410,190	3,779,310.81	2.68
Wire rope	Same	423,057.18	.30
Depreciation logging	Same	296,140.03	.21
Transportation costs:			
Railroad	1,410,190	2,425,527.83	1.72
Spur track	1,212.764	1,261,274.46	1.04
Water haul	296,140	281,333.03	.95
Other haul	267,936	511,758.16	1.91
Booming and rafting	352,548	56,407.62	.16
Boom stick towing	42,306	1,692.23	.04
Depreciation transportation	1,410,190	507,668.62	.36
General logging expenses:			
Salaries and wages	1,410,190	423,057.18	.30
Sundry expenses	Same	273,690.86	.19
Anticipated repairs			
Shutdown overhead			
Administrative expenses	1,410,190	648,687.68	.46
Total operating costs	Same	12,994,456.19	9.22
Stumpage	Same	4,289,049.89	3.04
Total cost logs produced	1,410,190	$17,283,506.08	$12.26

CHAPTER IV

MANUFACTURE

ANNUAL CUT BY SPECIES

Softwoods and Hardwoods.

About 80 per cent of the total lumber production of this country is composed of softwoods and the remaining 20 per cent of hardwoods.

Individual Species.

The accompanying table illustrates the annual cut of the principal species. The peak of lumber production occurred, and the most accurate and complete census was taken, in the year 1909, when the total lumber production was shown to be nearly 45,000,000,000 board feet.

In this statistical table, yellow pine includes North Carolina pine and the various southern yellow pines; western soft pine or western pine is called western yellow pine; white pine includes both the northern and Idaho white pine as well as Norway pine and jack pine; larch includes both western larch and eastern tamarack. The various species of oak, maple, spruce, hemlock, birch, hickory, basswood, ash, elm and cedar whether found in the East or West, or both, are included under the one name. There are fifty different oaks, thirty-four pines, seven spruces, four firs, four hemlocks, two larches, and twelve hickories in the United States.

The table also shows the states in which each species is chiefly cut. The initials I and D after some of the species are used to indicate a marked increase or decrease, respectively, in production during recent years.

ANNUAL LUMBER PRODUCTION 1909 AND 1920

Common Name.		Scientific Name.	1920 Million Feet Cut	1920 Per Cent Cut.	1909 Million Feet Cut.	1909 Per Cent Cut.	Principal States of Production in 1920.
Southern yellow pine	D	*Pinus palustris, Pinus echinata, Pinus taeda*, etc.	11,091	37.8	16,277	36.6	La., Miss., Texas, N. C., Ala., Ark., Va., Fla., Ga., S. C.
Douglas fir	I	*Pseudotsuga taxifolia*	6,960	17.1	4,856	10 9	Wash., Ore., Cal.
Oak	D	*Quercus alba, Quercus rubra*, etc.	2,500	7.8	4,414	9 9	W. Va., Tenn., Ky., Va., Ark.
Western yellow pine	I	*Pinus ponderosa*	2,290	5.1	1,499	3 4	Cal., Idaho, Wash., Ore.
Hemlock	D	*Tsuga canadensis* (e) *Tsuga heterophylla* (w)	1,850	5.1	3,051	6 9	Wis., Mich., Pa., W. Va., Wash., Idaho, Ore.
White pine	D	*Pinus strobus, Pinus monticola*, etc.	1,500	5.0	3,900	8.8	Idaho, Wash., Mont., Minn., Wis., Me., N. H., Mich.
Spruce	D	*Picea alba, Picea sitchensis*, etc.	825	2.8	1,748	3.9	Me., N. H., W. Va., Vt., Wash., Ore., Cal.
Maple		*Acer sp*	875	2.5	1,106	2.5	Mich., Wis., Pa., N. Y., W. Va.
Red gum	I	*Liquidambar styraciflua*	850	2.5	706	1.6	Ark., Tenn., Miss., La.
Cypress	D	*Taxodium distichum*	625	1 9	955	2.1	La., Fla., Ga., Ark.
Chestnut	D	*Castanea dentata*	475	1.6	663	1.5	W. Va., Penn., Va., Conn., N. C.
Yellow poplar	D	*Liriodendron tulipifera*	350	0 9	858	1.9	W. Va., Tenn., Ky., Va., N. C.
Redwood		*Sequoia sempervirens*	476	1 2	521	1.2	Cal. only
Larch		*Larix occidentalis, Larix americana*	390	1.1	421	0.9	Wash., Ore., Cal., N. Y., Me.
Birch		*Betula lenta, Betula lutea*, etc.	405	1.1	452	1.0	Wis., Mich., Me., N. Y., Vt.
Beech		*Fagus americana*	325	1.0	511	1 1	Mich., Ind., Pa., Ohio, N. Y., W. Va.
Cedar		*Thuja plicata, occidentalis*, etc.	332	1.0	346	0.8	Wash., Idaho, Ore., Cal. Tenn., Va., Mich., Ala.

ANNUAL LUMBER PRODUCTION 1909 AND 1920—*Continued*

Common Name.	Scientific Name.	1920		1909		Principal States of Production in 1920.
		Million Feet Cut.	Per Cent Cut.	Million Feet Cut.	Per Cent Cut.	
White fir	*Abies concolor*, etc	280	0.6	89	0.2	Cal., Ore,. Idaho
Elm,	*Ulmus americana*, etc	225	0.6	347	0.8	Mich., Wis., Ohio, Ind., Mo.
Basswood	*Tilia americana*	195	0.5	399	0.9	Wis., Mich., W. Va., N. Y.
Hickory D	*Hicoria sp*	170	0.5	333	0.8	Ark., Tenn., Ky., O., Ind.
Ash, D	*Fraxinus americana, nigra*	154	0.4	291	0.7	O., Ark., Ind., Tenn., Wis.
Cottonwood	*Populus trichocarpa, deltoides, heterophylla.*	144	0.4	265	0.6	Miss., Ar., La., Mo.
Tupelo I	*Nyssa aquatica*	180	0.4	96	0.2	La., N. C., Ala., Va.
Sugar pine I	*Pinus lambertiana*	133	0 4	97	0.2	Cal.
Balsam fir	*Abies balsamea*	68	0.2	108	0.2	Me., Minn., Vt., Mich.
Walnut	*Juglans nigra*	39	0.1	46	0.1	O., Ind., Ky., Ill., Mo.
Sycamore	*Platanus occidentalis*	28	0.1	56	0.1	Mich., Ind., Ark., Tenn.
Lodgepole pine	*Pinus murrayana*	16	0.1	23	0.1	Idaho, Mont.
All other		61	0.1	62	0.1	
Total		33,798	(1920)	44,509	(1909)	

By States.

The accompanying table, also taken from the U. S. Census figures, shows the annual cut by principal states of origin. As explained earlier in the text, there has been a rapid succession of changes among the principal lumber-producing states during the past seventy years.

PRODUCTION OF LUMBER, BY PRINCIPAL STATES, IN 1920

	M Feet, B. M.
United States	33,798,800
Washington	5,525,000
Oregon	3,317,000
Louisiana	3,120,000
Mississippi	2,224,000
California	1,513,000
Arkansas	1,452,200
Alabama	1,439,200
Texas	1,328,800
North Carolina	1,246,700
Wisconsin	1,059,900
Virginia	1,014,400
Florida	1,000,900
Idaho	970,000
Tennessee	779,800
Georgia	761,800
Michigan	749,800
West Virginia	697,600
South Carolina	610,500
Minnesota	576,300
Pennsylvania	520,000
Maine	505,600
Kentucky	421,100
All other	2,965,200

Regional Production.

In recent years the southern pine territory has supplied approximately one-third of the total lumber requirements of this country. There is a rapid movement, however, to the Far West, as lumber production is on the increase in that section whereas it is on the decrease in the South. It is estimated that within ten or fifteen years lumber production in the South will be only sufficient to meet local requirements.

Maine held the leadership in lumber production in this country from the early colonial times and for over two hundred years, until 1850. New York was the next leader, from 1850 to 1860, during which time it was not only the leading lumber-producing state but supplied 20 per

cent of the country's total requirements. Pennsylvania followed, from 1860 to 1870. The lumber industry next moved to the Lake States, during the period of rapid increase in population and Middle West development following the Civil War.

The culmination of the lumber production in the Lake States came in 1892 with a production of about 9,000,000,000 board feet. From that year there was a rapidly diminishing output from the pineries from Michigan, Wisconsin, and Minnesota and a gradual increase in pro-

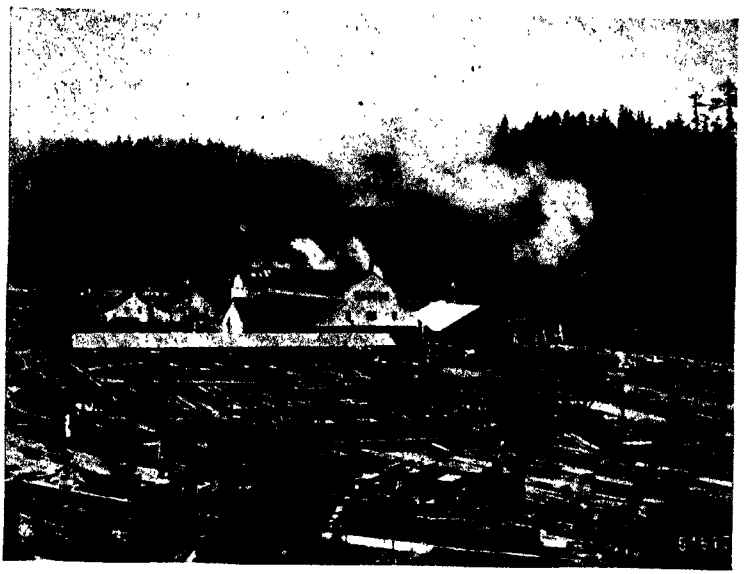


FIG. 10.—Large redwood sawmill at Scotia, California, with capacity of 200,000 board feet in 10 hours. (Photograph by U. S. Forest Service.)

duction from southern pineries. The high point in lumber production in the South was reached in 1909.

In 1894 the reduced freight rates for lumber from the Pacific Coast to the Middle West brought Douglas fir, western hemlock, redwood, western soft pine, and Idaho white pine into competition with the white pine from the Lake States and the southern pine from the South.

Up to 1894 there was only a local market along the Pacific Coast and in the export trade to furnish an outlet for the West Coast woods.

From that year there has been a rapid increase in development of western woods, and Washington is now the leading lumber-producing

state in the Union. For a long time in the future, the West Coast, with its enormous virgin supplies, heavy stands per acre, and large-sized trees, will be the great source of lumber production in this country.

METHODS [1]

Vast improvements have characterized the manufacture of lumber during the past fifty years. The old circular saw, which came into wide use about the year 1850, has been largely supplanted, except in small and portable mills, by the band-saw, which assumed importance in the lumber industry about the year 1890. From this time until 1909 there was a great increase in lumber production and many new inventions and facilities were brought in to multiply the production of lumber at the larger mills.

At the present time, in the majority of the modern and most efficiently equipped mills, band-saws, and in some cases double-cutting band-saws, are used, together with band-resaws, both vertical and horizontal. In addition, gang-saws are sometimes installed to increase the facilities for greater output. The manufacture of lumber in this country affords a great contrast to the methods employed in Europe, where the single frame or sash-saw or the gang-saw is used, and one practically never sees a circular saw or a band-saw, the circular saw being barred on account of the wide saw-kerf which it cuts. Both the circular saw and the band-saw are commonly used for head-saws in the mills of this country, and further refinements in manufacture are contributed by the gang- and band-resaws.

Circular saws are now commonly found only in large mills on the Pacific Coast as head-saws. Stumpage values are still relatively low there and logs cheap, so that wastage is not such an important item in the Northwest as it is in the Lake States, South and Northeast.

Lumber manufacture has also been characterized by the introduction of many labor-saving devices. Wages are relatively high, even in sawmills, in this country, and the maximum output per man is, therefore, desirable. Logs and lumber are seldom handled or moved by hand in the various operations through a modern sawmill. Live and dead rolls, conveyors, and traveling chains are universally employed to move the lumber and timber to and from the various machines.

[1] For an extended treatment of lumber manufacture see Lumber, etc., by R. C. Bryant, John Wiley & Sons, New York, and Lumber Manufacture in the Douglas fir region by H. B. Oakleaf, Commercial Journal Co., Chicago.

Modern sawmills require a very heavy investment—from $100,000 to $500,000 or more—and the original machinery will last only from fifteen to twenty-five years. This factor means a heavy charge for depreciation in lumber manufacture. On many operations, manufacturers figure that it costs about $1000 for each thousand board foot daily output, for the machinery, the building, and the labor necessary for the erection of the sawmill alone.

The methods of lumber manufacture are very similar on most of our large operations. The logs are usually brought to the sawmill on a log-

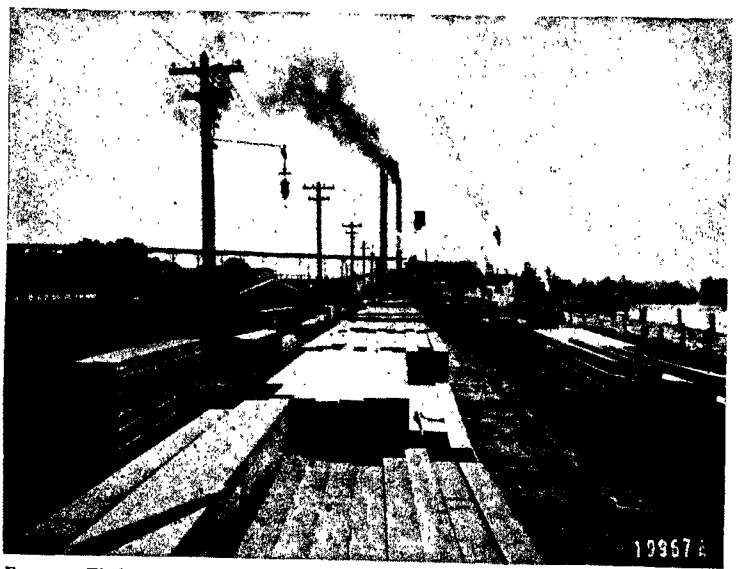


FIG. 11.—Timber docks at the rear of a large southern sawmill. Longleaf pine bridge timbers in the foreground. (Photograph by U. S. Forest Service.)

ging railroad or floated down a stream. At the mill, they are held in log ponds, usually one or more acres in area, for the purposes of storage, assorting and cleaning, and to prevent deterioration until they are wanted at the mill. At one end of the log pond a jack ladder or jacker chain is used to haul the logs from the level of the pond to the log deck on the second floor of the sawmill. Here a scaler usually scales the logs for their board-foot contents and either rolls them on the deck by hand or operates a steam kicker for this purpose. The log rolls down the deck to the log stop and loader where it is held until wanted by the sawyer. The latter releases the log stop, causing it to load the log on the carriage,

which conveys the log against the saw. The carriage is usually operated by steam and moves on a track. A steam nigger or log turner loads the log against the head blocks, usually three in number, on the carriage, and turns it to suit the judgment of the sawyer; a setter regulates the position of the log on the carriage and two doggers operate "dogs" which hold the log in position against the head blocks on the carriage.

The sawyer is the most important man in the mill, as he determines not only the quantity of lumber produced but the grades and sizes to be cut. A log can be cut in any one of many different ways, but by sawing around the defects and placing the knots and other defects which determine the grades of lumber the sawyer may waste or degrade great quantities of lumber. He stands in a box adjacent to the head-saw and regulates the movement of the turner or nigger, carriage, log stop, and loader, by means of levers and foot stops.

From the head-saw the lumber may be sent to a resaw or gang-saw if these are used. Timbers go directly to the rear of the mill to the timber docks without further manufacture of any kind. The cants or flitches are generally sent to the resaw or gang. The latter is commonly used to make edge grain or rift flooring. On the West Coast the resaw and gang are often used after trimming.

All lumber, after passing the head-saw or the gang or resaw, goes directly by means of transfer chains to the edgerman, who sends the boards against a series of circular saws which eliminate the bark on the edges of all boards or cut up boards to desired widths. The edgerman is also a very important man in a mill, as he may very readily raise or lower the grades of many boards or increase or decrease the output of a mill. Both he and the sawyer must be expert graders, as the question of grade is often much more important than the quantity to be produced.

From the edger the lumber is taken to the trimmer-saw. At one end of the trimmer table is a stationary saw, and at 2-foot intervals in softwood mills or 1-foot intervals in hardwood mills there are circular saws which may be elevated or depressed at the direction of the trimmer, so that all boards will be squarely trimmed. The trimmerman must also be an expert grader as he may elevate the grade of a board as, for example, from No. 1 common to a B and better grade in southern pine, or No. 2 clear and better in Douglas fir. His judgment, therefore, is very important in determining both the quality and the quantity of the output.

After leaving the trimmer the lumber goes to the sorting tables where it is graded and sorted and is then sent to the lumber piles or dry kilns.

In addition to the equipment briefly described above, some sawmills have two log decks and some of our largest mills have four log decks with two jack ladders. In times of active lumber markets two shifts are used, that is, the mill is operated day and night.

All waste, including edgings, slabs, trimmings, defective boards, and sawdust, is either sent against the slasher-saws to be cut into 4-foot lengths or conveyed directly to the burner. In some cases a "hog" is used to grind up the larger pieces into small chips for use under the



FIG. 12.—Excellently piled lumber along an alley at mill B, Weyerhaeuser Timber Co., at Everett, Washington. Note the even piling, raised foundations, careful sticking and adequate roofing. (Courtesy of Weyerhaeuser Forest Products.)

boilers. Wood fuel is almost universally used for power purposes, and the larger slabs and edgings are converted into lath or other small wooden materials.

MILL CAPACITIES

Although the early American sawmill was a small affair, cutting only a few board feet per day, with the increasing demand for lumber there has been a marked tendency toward the large sawmill, and at the

present time we have a few mills sawing around 1,000,000 board feet per day in two shifts. This tendency toward large producing units will continue until the large bodies of virgin forest are cut, and from that time on there will, no doubt, be a gradual decrease in the size of the invidual sawmill until the manufacturing plants are stabilized to cut the annual growth from given producing units, as is the case in the older countries of Europe.

There are between 30,000 and 40,000 sawmills in this country. The census of 1909 showed 46,584 lumber-manufacturing establishments. In the year 1919 there were 792 mills each cutting 10,000,000 board feet or more per year. Of these mills, over 18 per cent were in Washington, over 12 per cent in Louisiana, 8½ per cent in Oregon and 8 per cent in Mississippi. These four states reported 46.9 per cent of the total number of large mills and altogether produced 38 per cent of the country's lumber supply. By reference to the early part of this chapter it will be noted that these are still the principal lumber-producing states.

The census of 1919 showed 29,534 mills in the country, but the canvass made in this year was not as complete as that of 1909, and no doubt there are many more mills than actually reported their cut to the Government.

In 1918, 1290 mills, or 5.7 per cent of the total number in operation that year, produced 70.7 per cent of the total lumber cut.

As explained more fully elsewhere, American sawmills are seldom run to their full capacity. The installed equipment, if operated to capacity, would exceed the country's lumber requirements by over 100 per cent.

COSTS AND ACCOUNTING

The Southern Pine Association has made a very interesting compilation showing how each dollar was spent in producing lumber in both

	Cost per M. B. F.	Percentage of Total Cost.
Labor	$8 35	37.2
Supplies and manufacturing expenses	3.71	16.5
General overhead, including taxes, insurance, offices and office salaries and general expense	3.75	16.7
Depreciation	1.30	5.8
Stumpage	5.33	23.8
	$22.44	100.00

the logging and manufacturing, including stumpage, for one entire year (1921) as represented in the principal items of cost. This shows conclusively that, with all our labor-saving devices, labor is still the great item in the cost of producing lumber. It also demonstrates the relatively high charges for overhead and depreciation. This compilation was obtained from logging and manufacturing conditions of all sizes in all of the principal southern pine producing states.

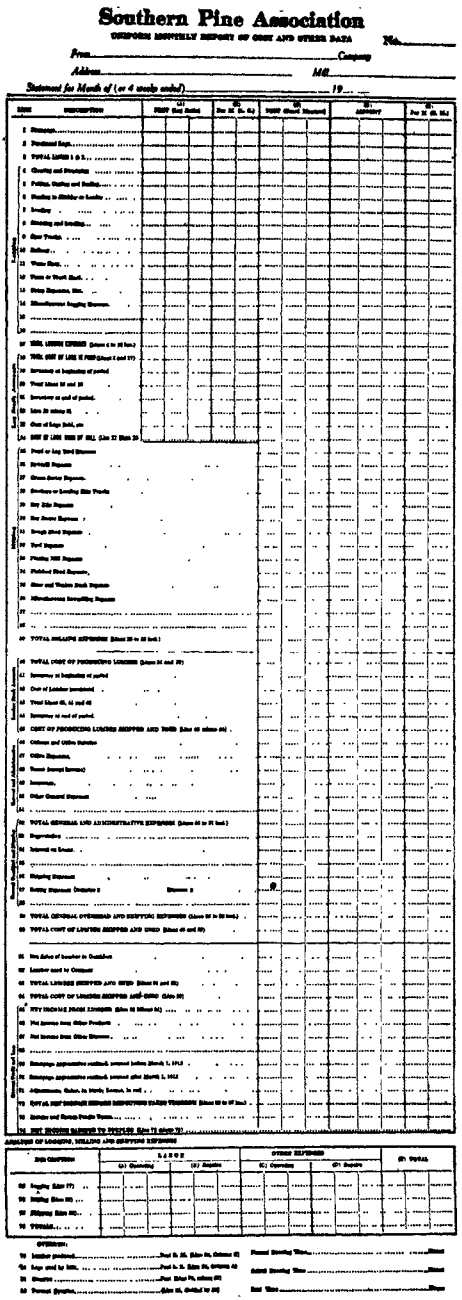
The following is a comprehensive statement of costs among the Douglas fir mills of the West Coast.

COST OF MANUFACTURING DOUGLAS FIR—YEAR 1922

82 Operations

Manufacturing Costs. Basis: Feet Handled.	Twelve Months Ending Dec. 31, 1922.		
	M Feet. Board Measure.	Total.	
		Amount.	Per M.
Pond or log yard	2,829,519	$ 311,247.09	$0.11
Sawmill	Same	6,847,435.98	2.42
Sorting table	2,606,200	1,485,534.00	.57
Dry kiln	903,100	903,100.00	1.00
Yard—Timber Dock	460,867	115,216.75	.25
Transportation	2,360,100	873,237.00	.37
Piling	1,210,910	423,818.50	.35
Rough dry shed	161,385	59,712.45	.37
Dry sorting	428,588	162,863.44	.38
Finished shed	645,209	180,658.52	.28
General	2,829,519	1,358,169.12	.48
Planing mill	1,933,054	3,498,827.74	1.81
Timber sizer	674,333	229,273.22	.34
Depreciation	2,829,519	2,093,844.06	.74
General manufacturing:			
Salaries and wages	Same	848,855.70	.30
Sundry expenses	Same	339,542.28	.12
Anticipated repairs			
Shutdown overhead			
Administrative	Same	3,294,155.38	1.16
Total manufacturing costs	2,829,519	$23,024,491.23	$8.14

The following is an outline of cost-accounting methods employed by the Southern Pine Association for both logging and manufacturing costs.



Southern Pine Association

UNIFORM MONTHLY REPORT OF COST AND OTHER DATA No.

From Company

Address Mill

Statement for Month of (or 4 weeks ended) 19

Line	Description	(1) Feet Log Scale	(2) Per M. Ft. (L)	(3) Feet Sheet Measure	(4) Amount	(5) Per M. Ft. Sht.
1	Stumpage					
2	Purchased Logs					
3	TOTAL LOGS 1 & 2					
4	Cutting and Skidding					
5	Felling, Cutting and Bucking					
6	Bucking to Skidder or Landing					
7	Loading					
8	Skidding and Hauling					
9	Haul Trucks					
10	Railroad					
11	Water Haul					
12	Taxes on Woods Stock					
13	Other Expenses, Min.					
14	Miscellaneous Logging Expenses					
15						
16						
17	TOTAL LOGGING EXPENSES (Lines 4 to 16 Incl.)					
18	TOTAL COST OF LOGS IN POND (Lines 3 and 17)					
19	Inventory at beginning of period					
20	Total Lines 18 and 19					
21	Inventory at end of period					
22	Logs Sold, etc.					
23	Cost of Logs Sold, etc.					
24	COST OF LOGS USED BY MILL (Line 22 Minus 23)					
25	Pond or Log Yard Expenses					
26	Sawmill Expenses					
27	Green Lumber Expenses					
28	Dockage or Loading Dry Docks					
29	Dry Kiln Expenses					
30	Dry Lumber Expenses					
31	Rough Mill Expenses					
32	Yard Expenses					
33	Planing Mill Expenses					
34	Finished Stock Expenses					
35	Shop and Tractor Work Expenses					
36	Miscellaneous Manufacturing Expenses					
37						
38						
39	TOTAL MILLING EXPENSES (Lines 25 to 36 Incl.)					
40	TOTAL COST OF PRODUCING LUMBER (Lines 24 and 39)					
41	Inventory at beginning of period					
42	Cost of Lumber produced					
43	Total Lines 41, 42 and 43					
44	Inventory at end of period					
45	COST OF PRODUCING LUMBER SHIPPED AND USED (Line 44 minus 45)					
46	Offices and Office Salaries					
47	Office Expenses					
48	Taxes (except Income)					
49	Insurance					
50	Other General Expenses					
51						
52	TOTAL GENERAL AND ADMINISTRATIVE EXPENSE (Lines 46 to 51 Incl.)					
53	Depreciation					
54	Interest on Bonds					
55						
56	Shipping Expenses					
57	Selling Expenses Domestic $ Export $					
58						
59	TOTAL GENERAL OVERHEAD AND SELLING EXPENSES (Lines 53 to 58 Incl.)					
60	TOTAL COST OF LUMBER SHIPPED AND USED (Lines 45 and 59)					
61	Net Sales of Lumber to Customer					
62	Lumber used by Company					
63	TOTAL LUMBER SHIPPED AND USED (Lines 61 and 62)					
64	TOTAL COST OF LUMBER SHIPPED AND USED (Line 60)					
65	NET INCOME FROM LUMBER (Line 63 Minus 64)					
66	Net Income from Other Products					
67	Net Income from Other Sources					
68						
69	Stumpage depreciation method, assessed before March 1, 1913					
70	Stumpage depreciation method, assessed after March 1, 1913					
71	Adjustments, Gains, or Losses, Inventories, or not					
72	NET PROFIT BEFORE FEDERAL INCOME TAXES (Lines 65 to 67 Incl.)					
73	Income and Excess Profits Taxes					
74	NET INCOME RETURNED TO PROFIT AND LOSS (Line 72 minus 73)					

ANALYSIS OF LOGGING, MILLING AND SELLING EXPENSES

Line	Item Captions	LABOR (a) Operating	LABOR (b) Repairs	OTHER EXPENSES (c) Operating	OTHER EXPENSES (d) Repairs	(e) TOTAL
75	Supplies (Line 17)					
76	Milling (Line 39)					
77	Shipping (Line 56)					
78	TOTALS					

OPERATION:

79 Lumber produced Feet B. M. (Line 42, Column 2)

80 Logs used by Mill Feet L. S. (Line 24, Column 2)

81 Shingles Pieces (Line 42, Column 3)

82 Normal Employees (Line 46, Divided by 26)

Normal Operating Time Hours

Actual Operating Time Hours

Rate Time Hours

FIG. 13.—Form for reporting logging and manufacturing costs each month by the members of the Southern Pine Association. Great progress has been made in recent years in uniform cost accounting.

WASTAGE IN MANUFACTURE

Operations have generally been very wasteful in the past, chiefly with respect to slabs, edgings, and trimming, during the course of conversion of the round logs to the sizes and shapes that are marketable. More or less criticism has been unjustly aimed at the lumber industry on account of this wastage, which is really due to the demands of the contractors, carpenters, builders, and the public, and to customs which arose years ago when forests were plentiful and lumber was cheap.

In the softwood business, the custom of trimming and edging so as to work lumber to even lengths and widths, is the source of one of the most wasteful practices in the industry. This is also a serious drawback to the conservation of our forests, and is the primary reason why European manufacturing operations can secure larger production from a given number of cubic feet. In other words, European mills saw their logs to both odd and even feet in length, or even half feet, and secure as great widths as the log will permit, whereas in this country, in the softwood industry, we must trim to even feet in length and even inches in width. The chief difficulty lies in the fact that the consumer has been educated and accustomed to the idea of even sizes in both lengths and widths and will not accept any other. As an illustration, if the contractor wants to use a 9-foot stick he generally purchases a 10-foot board and cuts off 1 foot, whereas in the production of lumber for a stick ultimately used 10 feet 6 inches long it is necessary to cut off 18 inches from a stick 12 feet long in order to make it salable. This is also relatively true of widths, a change in this ill-founded custom would not only result in an actual saving to the buyer, the contractor, and the manufacturer, but would also be of real practical assistance in conserving forest resources. The foresters of the country are working to assist the lumber industry in teaching the consumer of lumber to change these wasteful and unnecessary practices.

Another important illustration of waste in manufacturing operations is found in the handling of cut-offs from flooring. Recently hardwood flooring has been manufactured with end-matching, but this practice has not been generally adopted and used in the softwood industry, particularly in yellow pine and Douglas fir. After being end-matched, any length can be used in laying floor, whereas if flooring is not end-matched, it is necessary for the contractor to butt each stick. This results in waste of labor to the contractor and waste of material, besides

making it necessary for the softwood manufacturer to send all pieces under 4 feet in length to the burner or use them underneath the boilers.

Considerable wood is wasted in saw-kerf. Circular saws cut from $\frac{1}{4}$- to $\frac{1}{2}$-inch kerf, whereas the use of band-saws generally means a loss of only $\frac{3}{16}$-inch in sawdust. When a log is sawed into inch boards, it is readily seen how large the losses in sawdust may become.

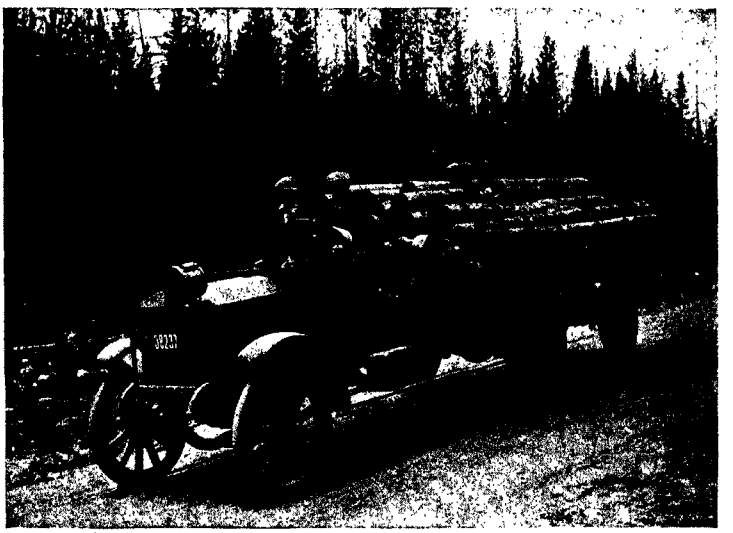


FIG. 14.—The use of the motor truck as well as tractor has made great advances in logging and manufacturing operations in all the important regions. This view was taken in the lodgepole pine forests of western Montana.

With valuable species, thin slabs are generally cut. The practice of accepting round edge lumber (without edging) for the box trade, in New England and elsewhere, is increasing, and assists materially in eliminating waste of valuable raw material.

In many mills where markets are available, slabs are being cut into lath in the case of softwoods, and in hardwoods they are often converted into parquetry flooring, dimension stock for chair rounds, shade rollers and miscellaneous small pieces. Edgings, defective butts, and trimmed ends are also worked up in the same way. Relatively little, however, has been accomplished in these respects.

TOTAL LUMBER AND OTHER WOOD PRODUCTION

Aside from lumber, this country makes large demands upon the forest for other wood products, many of which [1] are increasing in volume from year to year. In 1880, the United States produced only about eighteen billion board feet of lumber, whereas the present consumption is about 30 to 35 billion board feet.

The accompanying table shows the annual consumption of lumber and other wood products. It gives, first, the amount of the finished product itself, then its equivalent in thousand board feet as produced in the form of poles, shingles, staves, etc., then the wastage necessary in order to produce the final form or shape, and finally the total annual consumption, or the annual drain upon our forests through all means.

This table shows that the annual consumption of lumber in this country is about 300 board feet per capita per annum, and that of total wood about 200 cubic feet per capita per annum.

[1] See Forest Products; Their Manufacture and Use, by Nelson C. Brown, John Wiley & Sons, New York, 1919.



APPROXIMATE ANNUAL CONSUMPTION OF LUMBER AND WOOD PRODUCTS IN THE UNITED STATES*

Products.	Amount of Product.	Equivalent in Thousand Board Feet.†	Wastage ‡ in Production Thousand Cubic Feet.	Total Annual Consumption Thousand Cubic Feet.
Lumber, board feet	35,000,000,000	35,000,000	6,000,000	9,333,333
Fuelwood, cords	100,000,000	50,000,000	100,000	9,100,000
Fence posts, pieces	500,000,000	2,500,000	50,000	800,000
Cross ties, pieces	150,000,000	4,950,000	350,000	762,000
Pulpwood, cords	6,000,000	3,000,000	60,000	600,000
Round mine timbers, cubic feet	165,000,000	990,000	30,000	196,000
Shingles, pieces	12,000,000,000	1,200,000	100,000	160,000
Tannins—wood and bark, cords	1,300,000	650,000	33,000	150,000
Distillation wood, cords	1,500,000	750,000	12,000	147,000
Veneers, board feet	500,000,000	500,000	60,000	143,000
Slack cooperage, staves	1,328,968,000	553,700		
Slack cooperage, sets of heading	106,000,000	117,000	70,000	127,000
Slack cooperage, hoops	353,215,000	265,000		
Tight cooperage, staves	500,000,000	850,000		
Tight cooperage, sets of heading	40,000,000	133,000	90,000	122,000
Poles and piling, pieces	8,000,000	800,000	20,000	116,000
Lath, pieces	3,163,000,000	632,000	10,000	63,000
Excelsior, board feet	100,000,000	100,000	1,000	9,333
Miscellaneous, including rails, house logs, grape stakes, logs used in round, hop poles, concrete poles, props, vehicle stock, derrick poles, etc., not included above	.....	.....	.....	200,000
Total consumption	.....	.....	.....	22,029,666

Per capita consumption, estimating population at 110,000,000 people...200.27 cu. ft.

* Board feet of lumber have been converted to cubic feet at the rate of 12 board feet = 1 cubic foot, round material at 6 board feet = 1 cubic foot, cords to board feet generally at 500 board feet = 1 cord, and cords to cubic feet at 1 cord = 90 cubic feet.

† It is obvious that certain forms of forest products could not be actually converted into board feet, for example, fuelwood and pulpwood. The table is offered for the purpose of rough comparison. The amounts expressed in thousand board feet in this column have not been converted to cubic feet except in the case of lumber, veneers, and excelsior.

‡ This includes waste in logging, such as tops, stumps and cull logs, and waste in manufacturing, such as bark, kerf, slabs, trimming and edging, etc., but does not include waste by fire, insects, decay, windfall, etc.

CHAPTER V

SEASONING[1]

ALL freshly cut wood contains considerable water, which frequently constitutes one-third, sometimes more than two-thirds, of the weight of the wood. The removal of this moisture is called seasoning, or conditioning. All lumber requires at least partial seasoning for most purposes; generally the reduction of the moisture content to from 5 to 20 per cent of its oven-dry or bone-dry weight is necessary before the lumber is fit for use. The exceptions are in the case of piles or structures to be used under water, posts, and temporary mining timbers.

OBJECTS

The principal objects sought in seasoning lumber are as follows:

(1) Since railroad transportation charges depend directly upon weight, and long hauls are customary in the industry, the paramount reason for seasoning is to reduce shipping charges. Competition is keen on all our lumber markets, and the lowering of weight by the elimination of moisture is exceedingly important.

(2) Since all wood shrinks with drying, it is essential, for nearly all uses, that lumber, before being manufactured, be brought to the moisture condition in which it is to be used, as otherwise it will not hold its shape.

(3) Thoroughly dry wood cannot rot, as no fungus can grow on it, and as long as it remains dry no rot will occur. Consequently, thorough seasoning is a preservative process. Furthermore, kiln-drying at high temperatures (140° F. or over) will sterilize lumber in which mold and fungus growth have already started. Such defects as "blue stain," being products of fungus growth, are also prevented by seasoning.

(4) Seasoning greatly increases the strength, hardness, and stiffness, provided the wood is not injured by undue checking or honeycombing. Green wood is soft and weak in comparison with dry wood of the same species. Kiln-drying, when properly done, increases the strength to the

[1] For an extended treatise on the subject, particularly kiln drying, see The Kiln Drying of Lumber, by H. D. Tiemann, J. B. Lippincott & Co.

same degree as air-drying. In other words, properly kiln-dried lumber is equal to the best air-dried material in every respect.

(5) Lower grades actually develop in drying lumber, at least to a small extent; consequently, buyers prefer to purchase lumber that has been graded and inspected after seasoning.

(6) Timbers that are to be subjected to preservative treatment with creosote must in almost all cases be at least partially seasoned; otherwise the creosote will not enter the wood. Timber used for bridge construction, cross ties, poles, piling, mill construction, block paving, etc., may be more economically and successfully treated if first thoroughly seasoned. Sometimes rapid surface drying is accomplished in the hot oil during the treatment, but results are better if the timber has been previously dried.

PRINCIPLES AND METHODS

Seasoning is accomplished in three ways, as follows:

(1) Air-drying, or the natural process of seasoning, formerly the only method used and still employed to a large extent at most of our small local sawmill operations.

(2) Artificial methods of kiln-drying by which the process is hastened and intensified by means of heat and circulation of the air. This is coming into more and more extensive use, particularly in the United States. During the past decade it has been given a strong impetus by the great advantages and economies effected by advanced knowledge of better methods and kilns.

(3) A combination of the two. In the majority of cases, even to-day, lumber is first air-dried until it contains from 14 to 30 per cent of moisture, and finished to the desired condition in dry kilns.

Wood consists of minute cells arranged in a complex fashion. In the green state, the cells and intercellular spaces are saturated with water. During the process of moisture elimination, the cell walls harden, stiffen, and shrink. If the process of drying proceeds too rapidly, or if the exterior dries before the interior, casehardening, culminating in checking, warping and honeycombing, is likely to follow. Wood is an exceedingly complicated material, and its structure must be studied and understood before satisfactory results can be obtained in hurrying its drying process in kilns. Hardwoods are far more complicated than softwoods in the wood elements composing their structure, and methods of artificially drying one species are not necessarily applicable to another.

Large losses have attended attempts to dry lumber when the natural physical laws governing the structure of wood and its seasoning were not understood or followed.

The drying of wood is much more than the mere evaporation of moisture, as from a pile of sand or a cloth, on account of the physical behavior of the wood itself. It has taken many years of experimental study and research to discover and develop methods of accomplishing

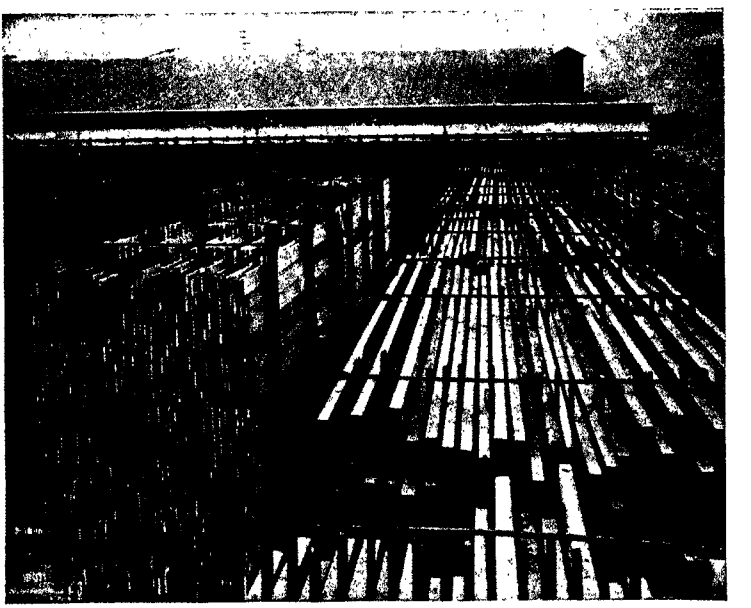


FIG. 15.—Dry kiln cars loaded with lumber automatically stacked on edge at Snoqualmie Falls, Washington.

the result without injury, and it is only within the last decade that lumbermen and lumber users in this country are coming to appreciate the necessity of properly drying their wood.

Shrinkage across the grain in tangential (flat grain) direction is about twice that in the radial (quarter-sawed) direction, whereas shrinkage in length is almost negligible. Shrinkage is in general, greater in hardwoods than in softwoods and is liable to be greater in heavy woods than in light-weight woods, although numerous exceptions occur.

The accompanying table shows the average shrinkage, from green

to oven-dry conditions, of a few representative species, as shown by Betts of the Forest Service.

Species and Locality.	Shrinkage in Per Cent.		
	Volume.	Radial (Across Grain).	Tangential (Along Grain).
Hardwoods			
White oak, Stone County, Ark	15.8	6.2	8.3
Hickory, Sardis, Miss	16.0	6.5	10.2
Maple, hard, Potter Co., Pa	14.7	4.8	9.2
Birch, red, Marathon Co., Wis	17.0	7.9	9.0
Poplar, yellow, Sevier, Tenn	11.4	4.1	6.9
Softwoods			
Douglas fir, Washington	12.3	5.0	8.3
Longleaf pine, Lake Charles, La	12.8	5.4	7.8
White pine, Shawano Co., Wis	7.8	2.2	5.9
Cypress, red, Louisiana	11.5	3.8	6.0
Larch, western, Missoula County, Montana	13.2	4.2	8.1
Spruce, western, Chehalis County, Wash	11.2	4.5	7.4

Some of the injuries common to lumber, incurred in the process of seasoning are:

Checking.—Splitting apart of the wood fibers. Checks are due to uneven shrinkage, and may be end checks or face checks. If the surface dries, and therefore shrinks, faster than the interior, the fibers separate at the surface, causing checks, to relieve the strain.

Casehardening.—When the surface dries much more rapidly than the interior, its tendency to shrink is arrested by the moist interior which is not yet ready to shrink. The surface then sets in an expanded condition. Later on, as the interior dries and starts to shrink, it is held from doing so by the dry shell, or "crust"; thus stresses are set up, which result in deformation, checking, splitting, and honeycombing.

Honeycombing is internal checking due to continued seasoning in the interior after lumber has surface-hardened or casehardened. This is the cause of some of the greatest losses in the utilization of lumber.

Warping, or twisting, is due to uneven shrinkage in different parts of the same piece of lumber or to stresses developed in casehardening. The cell structure and character of growth rings vary in different parts

of the same board and, during the drying process, this is an additional cause of trouble in warping, twisting, and checking.

Collapse occurs in fresh green wood of some species, if it is very wet when the drying process begins, particularly if it is heated to such a high temperature that there is a sinking in of the fibers. This is common in some softwoods, such as western red cedar and redwood, especially when swamp-grown. This phenomenon is distinct from shrinkage.

AIR-SEASONING

Air-seasoning is still applied in commercial practice to most species, and especially to hardwoods. Most lumber is first seasoned naturally in open piles.

Air-dried lumber is that which has diminished its moisture content to such a point that it is nearly in equilibrium with the surrounding air. The term air-dried lumber is loosely used and is applied to that which contains 15 to 20 per cent of its weight of water, or even more.

Time required to air-dry lumber depends upon:

(1) The species—Softwoods are usually easier to dry than hardwoods. An exception is cypress versus poplar.

(2) Thickness, width and shape of piece—Time required is in proportion to size.

(3) Time of year—Lumber dries quickest in warm, dry, windy weather and seasons slowly in winter or in damp seasons. Climate depends on temperature, humidity, wind, precipitation, etc.

(4) Method of piling, protective covering, etc.—These are very important.

Advantages of Air-seasoning as Compared with Kiln-drying.

It is cheap, requires little capital, and operators can use common labor.

Disadvantages of Air-seasoning as Compared with Kiln-drying.

(1) Capital is tied up in stocks waiting to be shipped. Interest charges alone may be high.

(2) Operator cannot take quick advantage of market conditions as is possible with kiln-dried lumber.

(3) Discoloration and degrading due to "bluing" or sap stain cannot be controlled or prevented.

(4) Weather and climatic conditions affect result.

(5) Process requires relatively large space, involving heavy charges for piling, runways, docks, taxes, insurance, etc.

(6) For many purposes, such as furniture, interior trim, flooring, etc., final kiln-drying is necessary.

Rules for Piling Lumber to Avoid Deterioration.

The following rules regarding methods of piling, foundations, species, etc., in air-seasoning lumber, were devised by Betts and published in Bulletin 552 of the Forest Service.

1. *Foundations.*

(*a*) The foundations should be strong and durable.

(*b*) The top of each foundation should be level; and from front to back the top surface of the parallel skids should be in alignment, so that the lumber to be piled will bear equally upon each one.

(*c*) The first skid should be raised above the second and the second above the third to allow a slant in the stack of 1 inch to every foot.

(*d*) The skids, preferably 2 by 4 inches, should be spaced not over 4 feet apart, except for heavy plank and timbers.

(*e*) The foundations should be of sufficient height to provide space for free circulation of air under all parts of the pile.

2. *Lumber.*

(*a*) Boards of equal length should preferably be piled together.

(*b*) The ends of the boards should rest upon the front and rear skids.

(*c*) A space approximately $\frac{3}{4}$ inch should be left between boards in the same layer when piling 1-inch, $1\frac{1}{4}$-inch and $1\frac{1}{2}$-inch lumber; 2 inches for 2-inch and $2\frac{1}{2}$-inch lumber; and 3 inches for material 3-inch and up.

(*d*) Lumber piled in the open should have the front ends of boards in each layer slightly protruding beyond the end of the layer beneath in order to provide a forward pitch to the stack of 1 inch to each foot in height.

3. *Stickers.*

(*a*) Stickers should be surfaced two sides and should be 2 inches wide, of uniform thickness, preferably $\frac{7}{8}$ inch for 1-inch lumber and $1\frac{1}{8}$ inches for 2-inch lumber. Their length should be a few inches in excess of the width of the pile.

(*b*) Stickers should be placed upon the layer of boards immediately over the skids and kept in alignment parallel to the front of the pile.

(*c*) The front and rear stickers should be flush with, or protrude beyond, the ends of the boards.

4. *Roof Protection.*

Cover boards, as a roof protection, should be laid on the top of the pile, extending a few inches beyond the front and rear end of the stack.

5. *Spacing Stacks.*

Space between the piles should not be less than 2 feet and increased to 4 or 5 feet if yardage conditions allow.

6. *Dimensions of Stack.*

The customary width of the stacks is 4 to 8 feet. The height is governed by the size and character of the lumber and by the methods of moving it.

7. *Treated Ends.*

Lumber 2½ inches thick or over, unless of the lower grades, should have the ends treated with a brush treatment of paint or some liquid filler.

8. *Ground Cover.*

The ground occupied by lumber piles should be covered to a depth of at least 4 inches with cinders (not ashes).

KILN-DRYING

Objects.—The objects sought in kiln-drying lumber from the green condition, aside from those enumerated as the general objects of seasoning, are as follows:

(1) Shortens the period between the time of manufacture and shipment. Returns are quicker, therefore capital is tied up for shorter periods. This is very important on many operations.

(1*a*) Enables orders to be filled on short notice.

(2) Eliminates many of the losses due to degrading. These losses are frequent in air-seasoning, but seldom occur in kiln-drying because drying conditions can be controlled.

(3) Prevents "bluing"—a common and serious defect of such lumber as sap gum, yellow pine, sugar pine, Idaho white pine, etc.

(4) Kills insects.

(5) Reduces yarding and handling charges.

(6) Makes unnecessary further expense in preparation for remanufacture, dressing, machining, etc.

(7) Is independent of season, weather, temperature, etc.

(8) Reduces shipping weights below those obtainable in air-seasoning.

(9) Is often necessary after air-drying, to bring the moisture content down to the point required for manufacturing and use.

Technical kiln-drying is a great step forward in conditioning lumber. The initial installation is expensive, but it generally pays in the long run. North Carolina pine, redwood, western hemlock, fir, western larch, and the better grades of yellow pine, Douglas fir, western soft pine,

Idaho white pine, white pine, etc., are now commonly kiln-dried right from the saw at the mills.

Hardwoods are still largely air-dried at sawmills, but are usually kiln-dried before being manufactured at the consuming point. The following forms of lumber are now being kiln-dried almost universally: furniture, flooring, cabinet and piano stock, refrigerators, interior trim, railway car stock, automobile parts, gun stocks, airplane stock, last blocks, wooden heels.

Many species, such as gums, elm, and western larch, formerly marketed with difficulty owing to improper methods of seasoning, are now

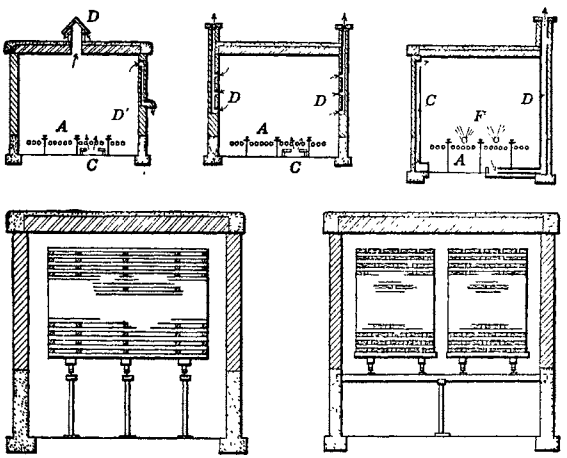


FIG. 16.—Above shows classes of ventilated kilns—from left to right; ventilation at top, side and bottom. *A*, heating unit; *C*, fresh air inlet; *D* and *D'*, used-air outlets; and *F*, humidifying unit.

Figures below show transverse section of a kiln, with cross pile at left and end pile at right. Note better opportunity for air circulation in end pile. (Courtesy of T. D. Perry.)

meeting a ready demand. It may be safely stated that modern kiln-drying methods have eliminated many serious losses of a decade ago, and that it is now possible to dry almost every wood in a way to make it valuable and useful.

Time Required to Kiln-dry Principal Species.

The following table shows the number of days required to kiln-dry the principal species, when they are green and fresh from the saw, as well as after they have been partially air-dried. The time required is

governed by the nature and behavior of the lumber and its initial moisture content, assuming that it is subjected in a suitable kiln to the proper temperature and humidity control. The table is based upon 1-inch stock. For drying thicker stock the drying time is directly proportional to the thickness; quarter-sawed lumber requires from 25 to 35 per cent more time to dry than plain-sawed lumber.

Species.	Days Drying Time in Kilns.				
	Green from the Saw.				Partially Air-dry (25 Per Cent Moisture Content). Days Number.
	Days Number.	Initial Moisture. Per Cent.	Temperature.		
			Initial Degrees.	Final. Degrees.	
Hardwoods					
Swamp oak	45–50	110	105	135	20–25
Northern oak	23	40	120	145	17–20
Walnut, cherry	20	70	120	145	13–15
African mahogany	9	40	120	145	5– 8
Tupelo, red and sap gum	14	110	140	180	10–12
Birch, ash	8	60	165	180	5– 6
Sycamore	23	110	120	145	9–12
Poplar, basswood	6	90	165	180	3– 5
Chestnut, butternut	14	80	140	165	8–12
Elm	8	80	165	180	4– 6
Maple, hickory	15	50	120	145	9–13
Softwoods					
Western larch	9–12	.....	140	165	4– 6
Some cypress, some redwood	10–18	100	165	180	6– 8
Incense cedar, spruce, some redwood	4– 6	40	180	200	3– 4
Douglas fir, yellow pine, western hemlock, some cypress	1– 3	40	220	235	

Comparative Strength of Air-dried and Kiln-dried Wood.

The question of the effect of drying methods upon strength of wood has always been a disputed one. Many claim that kiln-dried wood is stronger than air-dried wood and others vice versa. The United States Forest Products Laboratory at Madison has made some 150,000 comparative strength tests on both kiln- and air-dried specimens of twenty-

eight principal species of lumber. These tests have conclusively proved that proper kiln-drying and proper air-drying have the same effect upon the strength of wood.

Kiln-drying decreases the moisture content to around 5 to 8 per cent, whereas air-dried lumber contains from 15 to 20 per cent moisture. Inasmuch as wood increases in strength with loss of moisture, higher strength values are secured from kiln-drying than from air-drying; but this effect is of little significance in actual practice, because in final usage wood comes to practically the same moisture content whether it is kiln-dried or air-dried, the moisture content depending upon the conditions under which the wood is used.

The same kiln-drying processes cannot be applied with equal success to all woods, but if they are properly applied the result in relation to strength is the same as when air-seasoning is properly applied.

TYPES OF KILNS

Kilns are generally classified according to the system of obtaining drying conditions, that is, the regulation or control of humidity and circulation within the kiln itself. Heat is obtained in practically the same way in all types of dry kilns; that is, either by the use of steam coils or by means of steam radiators.

The following are the principal types of kilns:

Ventilated Kilns.

These depend upon chimneys for both circulation of air and elimination of the moist air. Humidity is supplied by steam spray pipes. Many of our most prominent dry-kiln operations are installed according to one of the types or adaptations of this general method. Examples of some of this type are the National, Standard, Grand Rapids, Moore, Emerson, Morton, North Coast, Curtiss, Hosey, etc.

Condensing Kilns.

These kilns depend upon cold water coils or water sprays to condense the water from the air and to create a circulation as well. Examples of this type of kiln are the Tiemann, Perkins, Hanrahan, and Andrews.

Forced Draft or Blower Kilns.

This type may either use fan blowers for circulation and spray pipes for humidifying the atmosphere, as in the American Blower, the Sturtevant, Northwest Blower Kiln, and Cutler Kilns, and the recently patented Forest Service Reversible Circulation Kiln,[1] or they may use the steam jet blowers for both circulation and humidifying, as in the Henderson Kiln.



FIG. 17.—Temperature and moisture control apparatus installed in operating room of Henderson type of dry kiln.

Superheated Steam Kilns.

These are in use on the West Coast for extremely rapid drying of softwoods, such as Douglas fir, hemlock, firs, and pines. The principle is the use of steam at temperatures above the boiling point in absence of air. This process brings on a very rapid circulation of steam at a low degree of superheat, 225 degrees up to 240 degrees. The kilns now in commercial use are based on a design gotten out by the Forest Service[2] several years ago, in which the circulation is periodically reversed in direction, and is induced by a series of high-pressure steam jets.

All the above kilns may be classified, as to the method of charging and unloading, as follows:

(*a*) Progressive kilns. In this type the lumber is put in at one end and an equal amount taken out at the opposite end, every day. Moisture conditions, therefore, vary throughout the length of the kiln; warm, moist air is usually pres-

[1] Tiemann-Thielen. [2] Tiemann.

ent at the entering end of the kiln, whereas at the discharge end the air is hot and dry. Most of the dry kilns installed in connection with lumber operations are of the progressive type, as they can be loaded and operated much more cheaply than other types and they make it possible to handle lumber much more economically and efficiently. Many arguments are advanced for and against this type of kiln. On account of the constant opening of the doors at both ends to charge and discharge the kiln, the humidity and temperature conditions cannot be regulated very accurately.

(*b*) Compartment kilns. In this type the entire kiln is charged at one time and the drying conditions varied to suit the conditions of the lumber. When the lumber has reached a suitable stage of conditioning it is all discharged at one time and a new charge is placed in the kiln. Thus, there is no opening or closing of doors to influence the temperature and humidity at any time, as in the progressive type of kiln.

PREVENTION OF SAP STAIN

With the introduction of refinements in the seasoning of lumber both by artificial and natural means, the prevention of sap stain, a defect which has caused so much difficulty in the trade, has assumed great importance.

Blue stain, or bluing, is commonly found in the sapwood of a large number of woods, both hardwoods and softwoods. Blue stain is caused by a fungus which appears very rapidly both on the ends of logs and on freshly cut boards when favorable conditions of atmospheric moisture and temperature are present. Blue stain appears at first in the form of small spots or streaks; later, as the living fungus develops further, the entire sapwood may be colored a light blue and, still later, a deep blue. If the growth is permitted to develop unchecked it may leave a mold on the surface. On certain species, such as sap gum, which is very acid in its nature, the growth of sap stain is particularly rapid. It is also common on southern pine, white pine, western soft pine and Idaho white pine. Among the other hardwoods it is found on yellow poplar, basswood, and a number of other species, where its effect on the light-colored sapwood gives it a disagreeable appearance.

Other fungi produce stains of various colors, including yellow, red, brown, blue, green, and black, but they are rather uncommon. In some cases stains are produced chemically by ferments within the wood itself. Discoloration of a chemical nature, not due to fungus, sometimes develops in kiln-drying lumber, but the chemical action which causes it has not yet been explained.

Blue stain and other stains do not seriously affect the strength properties of wood but they often lessen its value when it is to be used for certain purposes. This is particularly true of wood used in cooperage, box boards, veneers and vehicle and furniture stock, lumber and timber for export and for finishing purposes. In some countries, such as Spain and the Argentine, blue lumber is considered very objectionable.

There are three methods of preventing fungus stains on wood, namely: (1) air-seasoning; (2) kiln-drying; (3) use of antiseptic solutions.

Air-drying is effective when used properly, but during the spring and early summer seasons, when there is high humidity, it is exceedingly difficult to prevent staining of lumber, particularly in the South. Kiln-drying, when properly applied to green lumber, is very effective in preventing stain. The United States Forest Products Laboratory has determined that temperatures of 140° F. maintained for three hours in a saturated mixture will kill blue stain in 1- to 2-inch stock. Steaming at 170° F. to 180° F. for a period up to one hour will prevent the growth of molds or fungi. It should be understood that kiln-drying does not remove stain already developed but prevents its growth by sterilizing the lumber.

The most common method used to prevent sap stain, particularly in the South, is the application of some antiseptic treatment. Specialists have determined that sodium carbonate and sodium bicarbonate are the most effective chemicals commonly employed to prevent the growth of stains. As the lumber comes fresh from the saws it is passed, on chains or by hand, through a trough or tank filled with chemical solution. The solution is usually heated, and care is taken that all portions of the lumber are thoroughly saturated on the surface. This is not, however, a complete preventive, and kiln-drying before the stain has occurred is to be preferred.

On rainy days, an 8 per cent solution of sodium carbonate is used, whereas in dry weather a 4 per cent solution is sufficient. With sodium bicarbonate an 11 per cent solution is used in wet weather and 5 or 6 per cent on dry, clear days.

Other chemical solutions have been used with varying success. After

dipping, the lumber is carefully stuck in open piles to insure thorough ventilation and quick-drying conditions. Sticker strips that have been run through the same solution should be used on lumber piles.

The cost of mechanically dipping lumber by the above means may be from 10 to 15 cents per thousand board feet, at the 1923 costs of chemicals and labor.

CHAPTER VI

GRADES AND INSPECTION

HISTORY

From the earliest times, the conversion of round trees into desired shapes and sizes for commercial use has been attended by the separation of the product into different classes, according to the use to be made of it. Records show that in 1764 the first classification of lumber into different grades was published in Sweden. Four grades were recognized, ranging from the best to the poorest, or culls. Fundamentally these grades were the same as those in use to-day in the important Scandinavian timber trade.

Lumber is still sometimes sold "mill run"; that is, the whole product of the log is sold together, without separation into grades. In the past, the middleman or retailer usually separated lumber into various grades before it reached the consumer.

In the early days of the lumber industry in this country, each mill used its own system of grading, or separating the good, or merchantable, from the poor, or cull, lumber. In 1830, Maine established by law the recognition of four official grades of white pine and authorized an inspector to enforce their use. These grades followed practically the same lines as the first Swedish grading rules. As the industry migrated westward and southward, these early rules and customs followed, but they were expanded and developed to meet the rapidly changing conditions of the lumber trade and the demands of the market.

The year 1890 was a landmark in the progress of the industry, particularly with respect to the following outstanding features:

1. Formation of manufacturers' associations, chiefly to agree upon uniform grading rules and to eliminate the confusion arising from the use of many independent systems.

2. A rapid expansion and development in grading rules, particularly in those relating to white pine, to meet the conditions of an expanding and varied market in both building and industrial operations.

3. Development of systems of inspection to protect both buyer and seller.

From the Lake States the rules governing the grading of white pine were carried to the Inland Empire, California, and other western states. The rules of the Western Pine Association and California White Pine and Sugar Pine Association, as applied to Idaho white pine, western soft pine (including both California white and western pine), follow very closely those applying to northern white pine.

Since the World War, it has been felt that grading rules and nomenclature were becoming too complex, and that it would be for the best interests of all concerned, including manufacturer, wholesaler, retailer, and consumer, to simplify and standardize the shapes, sizes, grades, and nomenclature, in the same way that improvements in this respect have been brought about in other important and basic American industries.

BASIC PRINCIPLES AND OBJECTS OF GRADES

If all trees were cylindrical and straight, were free from knots, and other defects, showed the same width of ring, and contained little or no sapwood, there would be no occasion for classifying the lumber product into grades. But, unfortunately, every tree literally grows in a different way and more or less deficient in features which render it valuable or desirable for certain purposes. For structural purposes strength is desirable; therefore, the direction and width of growth rings, size, number, and location of knots, are important. For making doors, sash, furniture, finish, and for similar uses, the public demands boards which are clean or clear, on one face; for cabinet work, a fancy grain, or figure, is of paramount importance; for flooring, quarter-sawed stock wears longer and looks better; for sheathing, all that is required is lumber that will hold together and retain its place when nailed; for siding, clear, durable woods, capable of absorbing and retaining paint, are required.

The objects of grading rules, therefore, are to classify and place on the market lumber of uniform sizes, shapes, and qualities, irrespective of the varying conditions of manufacture and the character and size of the trees which produce it. Thus, the manufacturers of a given species can compete on an equal basis in the same markets, irrespective of the kind and nature of the forests in which their mills are located.

The fundamental basis of grades is freedom from defects. The

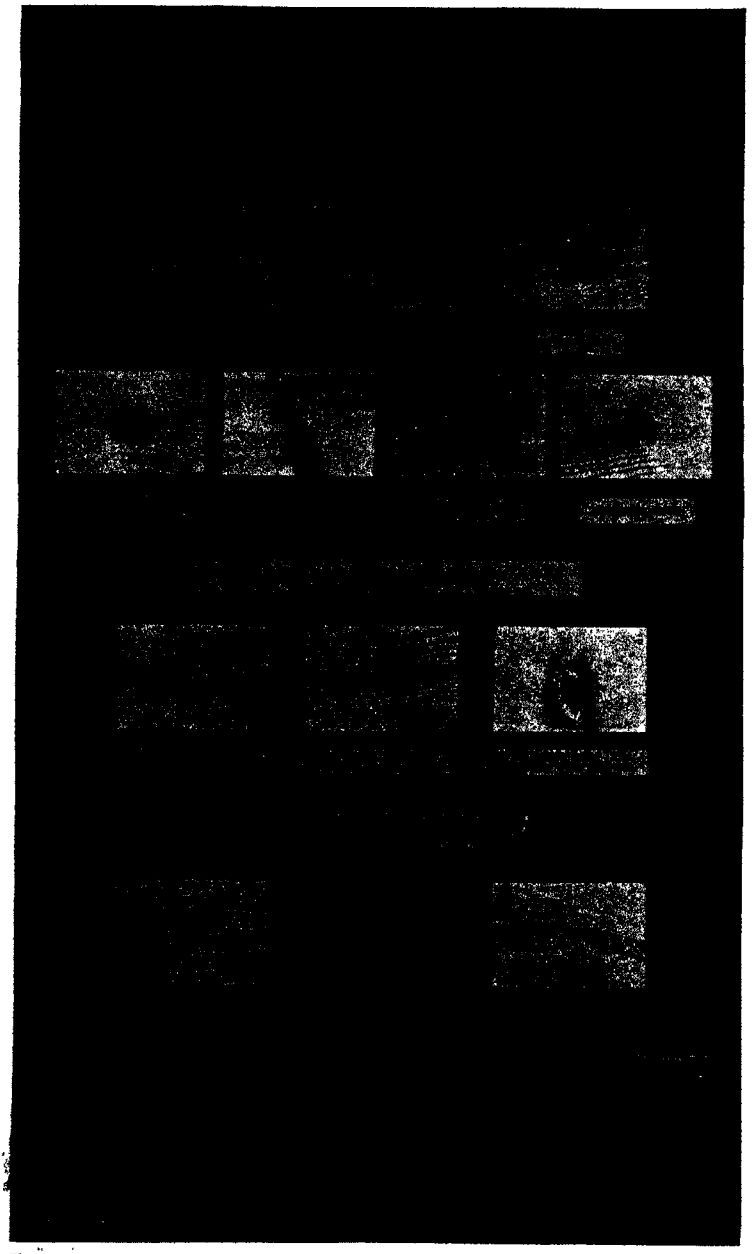


FIG. 18.—Classification of knots by shape, condition and size and other defects frequently found in grading lumber. (Courtesy of the U. S. Forest Service.)

nature and character of these defects vary considerably with the species. The large amount of resin frequently found in most conifers, and never in hardwoods, is an important feature in grading the former. The sap of some species becomes easily blue-stained, shake is a defect peculiar to certain species, etc. The location or position, form, number, and size of visible defects and blemishes determine the grade of every piece of lumber.

The following definitions are the basis of the suggested grades, as promulgated by the Central Committee on Lumber Standards at Washington:

Definitions of Defects and Blemishes

A defect is any irregularity, occurring in or on wood, that may lower some of its strength values, durability or serviceability.

A blemish is anything, not classified as a defect, marring the appearance of the wood.

The commonly recognized defects and blemishes occurring in yard lumber and structural timbers are: knots, pitch, pitch streaks, pitch pockets, wane, holes, discoloration, decay, checks, shakes, cross grain, imperfect manufacture, spilts, warp, pith.

Knots

Knots shall be classified according to size, form, quality and occurrence.

The average of the maximum and minimum diameters shall be used in measuring the size of knots, unless otherwise stated.

Size

A pin knot is not over $\frac{3}{8}$ of an inch in diameter.

A small knot is one from $\frac{3}{8}$ to $\frac{3}{4}$ of an inch in diameter.

A standard knot is one from $\frac{3}{4}$ to $1\frac{1}{2}$ inches in diameter.

A large knot is over $1\frac{1}{2}$ inches in diameter.

Form

A round knot is one whose maximum diameter is not over one and one-half times as great as its minimum diameter.

An oval knot is one having its maximum diameter one and one-half to three times as great as its minimum diameter.

A spike knot is one sawed in a lengthwise direction whose maximum diameter is over three times as great as its minimum diameter.

Branch knots are two or more knots branching from a common center.

Quality

A sound knot is solid across its face, as hard as the surrounding wood and shows no indications of decay.

An unsound knot is solid across its face, as hard as the surrounding wood, but containing incipient decay.

A decayed knot is softer than the surrounding wood and contains advanced decay.

A tight knot is one so fixed by growth or position that it will firmly retain its place in the piece.

A loose knot is one not held firmly in place by growth or position.

An intergrown knot is one whose growth rings are completely intergrown with those of the surrounding wood.

An encased knot is one whose growth rings are not intergrown and homogeneous with the growth rings of the surrounding wood. The encasement may be partial or complete.

A watertight knot is one whose growth rings are completely intergrown with those of the surrounding wood on one face of the piece, and which is sound on that face.

A pith knot is a sound knot, except that it has a pith hole in the structural center. The hole shall not exceed ¼ of an inch in diameter.

Occurrence

A single knot is one occurring by itself with the fibers of the wood in which it occurs deflected around it.

A knot cluster is two or more knots grouped together as a unit with the fibers of the wood deflected around the entire unit. A group of single knots is not a knot cluster.

Pitch

Pitch is a poorly defined accumulation of resin in the wood cells in a more or less irregular patch.

Pitch Streaks

A pitch streak is a well-defined accumulation of pitch in the wood cells in a more or less regular streak.

A small pitch streak is one whose area does not exceed the product of $\frac{1}{12}$ the width by one-sixth the length of the face on which it occurs.

A medium pitch streak is one whose area does not exceed the product of one-sixth the width by one-third the length of the face on which it occurs.

A large pitch streak is one whose area exceeds the product of one-sixth the width by one-third the length of the face on which it occurs.

Pitch Pockets

A pitch pocket is a well-defined opening between annual layers of growth usually containing more or less pitch, either solid or liquid. Bark may also be present in the pocket.

A scab pitch pocket is one appearing on the surface parallel with or tangential to the annual layers of growth.

A very small pitch pocket is one not over ⅛ of an inch in width and not over 2 inches in length.

A small pitch pocket is one whose maximum width may increase from ⅛ of an inch to ½ of an inch provided a maximum length of 4 inches decreases to 2 inches proportionately as the width increases.

A medium pitch pocket is one whose maximum width may increase from ⅛ of an

inch to ⅞ of an inch provided a maximum length of 9 inches decreases to 3 inches proportionately as the width increases.

A large pitch pocket is one whose width or length exceeds the sizes stated as permissible for a medium pitch pocket.

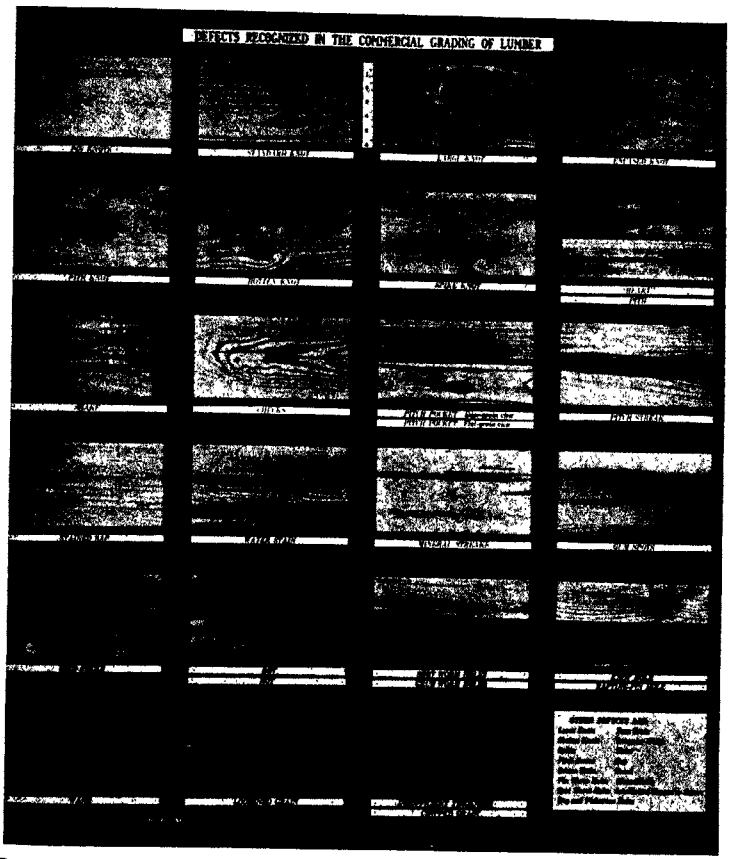


FIG. 19.—Some of the principal defects recognized in grading lumber. (Courtesy of the U. S. Forest Service.)

WANE

Wane is bark or the lack of wood, from any cause, on the edge or corner of a piece.

HOLES

Holes in wood may extend partially or entirely through the piece. They are enumerated as knot, dog, picaroon, bird, insect (including pin, shot, spot and grub worms, etc.) metal and wooden rafting pinholes, through pitch pockets, and the like.

When holes are permitted, the average of the maximum and minimum diameters measured at right angles to the direction of the hole shall be used in measuring the size, unless otherwise stated.

A pin worm hole is one not over $\frac{1}{16}$ inch in diameter.

A small grub worm hole is one not over $\frac{1}{4}$ inch in diameter.

Discolorations

Discolorations on or in lumber are enumerated as weather, sticker, water, or fungus (such as blue stain, etc.) stain; brown stain; kiln burn; and similar color changes due to a combination of temperature, moisture, chemicals, etc. Discolorations may follow insect attack, bird peck, etc.

A light discoloration is paler than the medium discoloration and occurs in approximately one-fourth of the stained stock.

A medium discoloration is a shade most commonly found and which occurs in approximately one-half of the stained stock.

A heavy discoloration is darker than the medium discoloration and occurs in approximately one-fourth of the stained stock.

Decay

Decay is disintegration of the wood substance due to the action of certain kinds of fungi.

Incipient decay is the early stage of decay usually detected by a discoloration of the wood which seems to be firm and solid.

Advanced decay or rot is noticeable as a decided softening or breaking down of the wood.

Checks

A check is a separation of the wood, the greater part of which occurs across the growth rings.

A surface check is a check occurring on the surface of a piece.

A small surface check is a perceptible opening not over 4 inches long.

A medium surface check is one not over $\frac{1}{32}$ of an inch wide and 10 inches long.

A large surface check is one over $\frac{1}{32}$ of an inch wide and 10 inches long.

An end check is one occurring on an end of a piece.

A through check is one extending from one surface through the piece to the opposite face or to an adjoining face.

Honeycombing is checking occurring in the interior of a piece; often the checks are not visible on the surface. On a cross-section they usually appear as slits, or as open pockets whose width may appear very large in proportion to the radial length.

Shakes

A shake is a separation of the wood, the greater part of which occurs between the growth rings. (Thus any shake is a ring shake.)

A fine shake is one with a barely perceptible opening.

A slight shake is one with an opening not over $\frac{1}{32}$ of an inch wide.

A through shake is one extending from one surface through the piece to the opposite face or to an adjoining face.

Cross Grain

Cross grained wood is that in which the wood cells or fibers do not run parallel with the axis, or sides, of a piece.

Imperfect Manufacture

Imperfect manufacture includes all defects or blemishes which are produced in the manufacturing process, such as chipped grain, torn grain, loosened grain, non-uniform width or thickness, skips in dressing, mismatching, miscut, machine gouge, machine burn, insufficient tongue or groove, and like defects.

Chipped grain means that a part of the surface is chipped or broken out in short particles below the line of cut, and, as usually found, should not be classed as torn grain.

Torn grain means that a part of the wood is torn out in reasonably long pieces, and is of four distinct characters—slight, medium, heavy, and deep.

Slight torn grain is not over $\frac{1}{32}$ of an inch in depth.

Medium torn grain is from $\frac{1}{32}$ to $\frac{1}{16}$ of an inch in depth.

Heavy torn grain is from $\frac{1}{16}$ to to $\frac{1}{8}$ of an inch in depth.

Deep torn grain is over $\frac{1}{8}$ of an inch in depth.

Loosened grain means that a small portion of the wood has become loosened but not displaced. This usually appears as incipient shake at the points where the annual layers of growth come to the surface.

A skip is an area on a piece that failed to surface smooth.

A slight skip is one whose area does not exceed the product of the width of a piece by 3 inches of its length.

Mismatched material is worked material that does not fit tightly at all points of contact with the piece which it adjoins and on which the surfaces of adjoining pieces show a variation over $\frac{1}{32}$ of an inch.

A machine gouge is a groove across a piece due to the machine knives cutting below the desired line of cut.

A machine burn is a darkening or charring of the wood due to overheating by the machine knives.

Miscut lumber is that which has a marked variation in thickness or width at different places on a piece such as results from a waving of the saw during manufacture.

Splits

A split is a lengthwise separation of the wood due to the tearing apart of the wood cells.

Warping

Warping is any variation from a true or plane surface. It includes crook, bow, cup, and twist, or any combination of these.

Crook is a deviation edgewise from a straight line drawn from end to end of a piece and is measured at the point of greatest distance from the straight line. It is known as slight, small, medium and large.

Based on a piece 4 inches wide and 16 feet long, the distances for the different degrees of crook shall be for slight crook a maximum of 1 inch small crook, 1½ inches; medium crook, 2 inches, and large crook over 2 inches. For wider pieces it shall be ¾ inch less for each additional 2 inches of width. Shorter or longer pieces may have the same curvature.

Cupping is the curving of a piece across the grain or width of a piece. It is measured at the point of greatest deviation from a straight line drawn from edge to edge of a piece.

Based on a piece 12 inches wide, the distance for the different degrees of cup shall be for slight cup a maximum of $\frac{1}{4}$ inch; medium cup, $\frac{1}{2}$ inch, and heavy cup, $\frac{3}{4}$ inch. Narrower or wider pieces may have the same curvature.

PITH

Pith is the small soft core occurring in the structural center of a log.

The following is a general classification of grades according to their purpose and utility:

1. Grades in which the prime consideration is that of structural requirements. Such grading is done on a basis of strength, durability, percentage of heartwood, density (number of rings per inch and proportion of summerwood), and uniformity of manufacture. This applies chiefly to structural timbers and dimension stock.

2. Grades in which the chief consideration is given to the amount of clear cuttings obtainable. In the softwood trade these grades are known as shop or factory grades and are important for cutting into smaller sizes and shapes useful for sash, doors, and other purposes where small clear pieces are required. The same custom prevails in the hardwood trade, where the prime factor is the number of clear cuttings obtainable for flooring, fixtures, furniture, cabinet work, agricultural implements and automobile parts, etc. Factories usually prefer to purchase hardwood lumber in the rough and work it up to suit their particular requirements. For example, No. 2 common maple, birch, and beech, are frequently worked up into clear cuttings for small, clear flooring.

3. Grades applying to what is known as yard stock, and referring to sizes usually carried in retail yards for home building, ready for immediate use without further manufacture or working. This includes such dimension stock as 2×4, 2×10, ceiling, siding, sheathing, stepping, partition, sills, etc., which have usually been cut or dressed to the desired width, thickness, and lengths for use without further cutting.

APPLICATION IN THE INDUSTRY AND NOMENCLATURE

Each manufacturers' association adopts and promulgates grading rules for its own lumber product, and these are generally accepted in the trade. The associations and the woods to which their rules apply are described in the chapter on Lumber Associations.

An exception to this general rule is found in the fact that hardwoods and cypress are cut by the mills of the Southern Pine Association as well as by hardwood mills, and are generally graded in these mills according to the rules of the National Hardwood Lumber Association. The latter is an organization composed of both wholesalers and manufacturers.

There is practically no uniformity in nomenclature. The best grades of white pine are called "A," "B," "C," etc., in order; those of Douglas fir, western spruce, hemlock and redwood are called "clears," the two best grades of hardwoods are generally combined into one grade, called "firsts and seconds," and the best grades of southern pine, called "A" and "B," are usually combined into one grade, called "B" and better."

In white pine there are forty-nine separate and distinct grades.

In hardwoods there are relatively few grades for each species; in order of quality they are: firsts and seconds, selects, No. 1, common, No. 2 common, No. 3 common, and culls.

Timbers are usually manufactured in one grade; namely, No. 1 common in yellow pine and Douglas fir, and merchantable in eastern spruce and hemlock, unless a select structural grade, the requirements for which are slightly more rigid than for those No. 1 common, is specified.

The Northern Pine Association devised and adopted the first formal and uniform grading rules, and nearly every association has copied these rules to a greater or less extent, both in nomenclature and in description of grade.

Many special grades have been adopted and recognized to suit particular uses. For example, there is sound wormy chestnut, devised to meet the demand for veneer cores, laminated and built-up stocks, and caskets; there are wagon box boards 13 to 17 inches wide for special purposes requiring wide boards in basswood tupelo, red and sap gum, yellow poplar, cottonwood and magnolia. "Roofers" are No. 2 common boards, usually D2ST&G in 6-, 8-, 10- and 12-inch widths used principally for sheathing, under-flooring, fencing, temporary structures and roofing boards. Other special grades are panel stock, in yellow poplar, 18 inches or more in width or redwood and cypress specialties, such as tank and silo stock; Douglas fir pipe staves, etc.

The following are general instructions[1] issued by one of the manufacturers' associations in reference to the grading of lumber at member mills. Although they apply to special species, they give an excellent

[1] From the Grading Rules of the West Coast Lumbermen's Association for 1922.

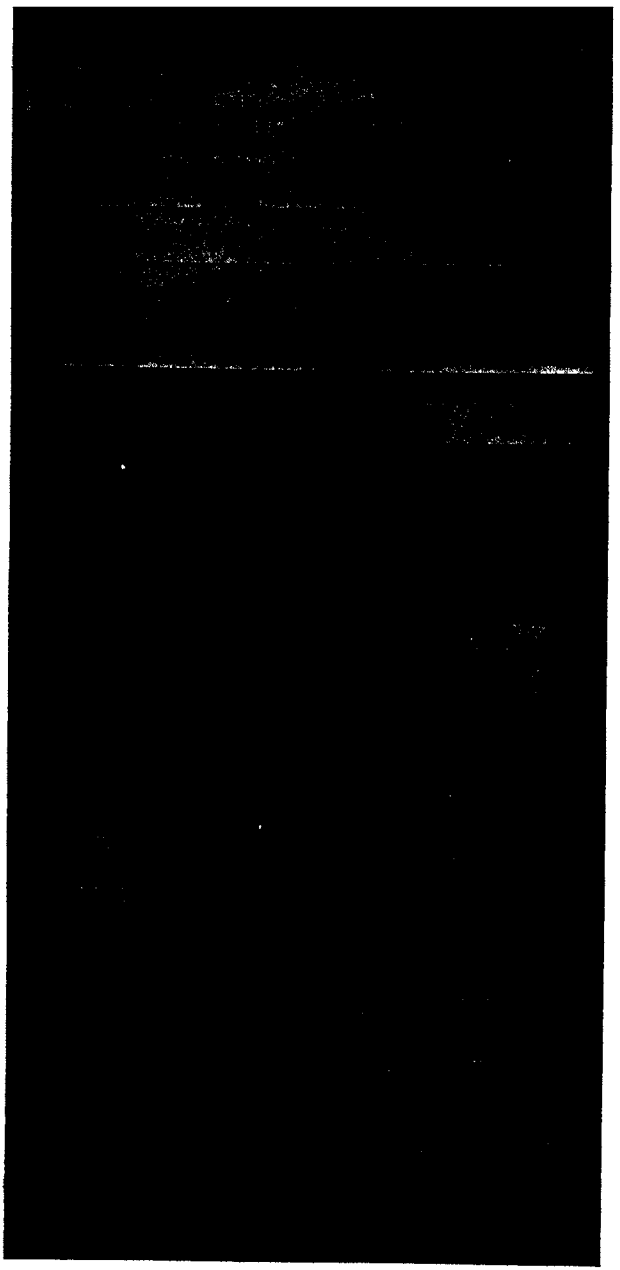


FIG. 20.—Upper group shows typical No. 1 shop common boards, center group No. 1 and 2 clear and lower group box or No. 3 common. All of California white pine.

idea of the usual considerations followed in grading lumber in general. Several differences may be noted as applied to other species.

All lumber is graded with special reference to its suitabliity for the use intended. With this in view each piece is considered and its grade determined by its general character, including the sum of all its defects. A shipment of any grade must consist of a fair average of that grade and cannot be made up of an unfair proportion of the better or poorer pieces that would pass in that grade. A shipment of mixed widths shall contain a fair assortment of each width. A shipment of mixed lengths shall contain a fair assortment of each length.

The grade of all regular stock shall be determined by the number, character, and position of the defects visible in any piece.

The enumerated defects herein described in any grade are intended to be descriptive of the coarsest piece such grades may contain.

Defects in lumber are to be considered in connection with the size of the piece and for this reason, wider, longer pieces will carry more defects than smaller pieces in the same grade. Defects in flooring, ceiling, partition, casing, base, drop siding and rustic are based on a piece 4 inches wide and 12 feet long except where otherwise specified.

What is known as "Yard lumber" such as Dimension, Common Boards, Finish, etc., is graded from the face or best side, except that lumber which is dressed one side only is graded from the dressed side. Joist sizes, i.e., 6-inch and wider shall be graded for strength.

Flooring, ceiling, rustic, drop siding, bungalow siding and bevel siding at shipper's option may be shipped S1S or with reverse side partially surfaced, hollow or grooved back, or rough. Should any degree of surfacing of reverse side be required it must be specifically stated on order.

Factory lumber, which is used for the manufacture of doors, sash, etc., and must show on both sides, is always graded from the poorer side. The grade is determined by the quantity of suitable cuttings obtained from each piece.

Material not conforming to standard sizes and grades shall be governed by special contract.

In the absence of a special agreement between the buyer and seller for each order, all dressed lumber is finished to the sizes specified in these rules.

The standard lengths for lumber are multiples of 1 foot and 2 feet as specified herein.

All dressed lumber shall be measured and sold at the full size of rough lumber used in its manufacture.

All lumber 1 inch or less in thickness shall be counted as 1 inch thick.

Splits and checks shall be considered as to length and direction as herein specified.

Equivalent means equal and in construing and applying these rules the defects allowed are understood to be equivalent in damaging effect to those mentioned applying to stock under consideration.

Where a base grade and better is ordered, for instance No. 2 and Better Common, it shall mean principally No. 2 Common with a small percentage of the higher grades of common. This does not contemplate furnishing a log run grade, but merely a grade of Common. No. 3 Clear and Better shall mean principally No. 3 Clear. Any variation from this shall be subject to special contract.

If "mill run" or "log run" is ordered it shall mean the entire product of the log, with all culls eliminated. Culls shall be defined as all lumber falling below No. 3 Common.

No arbitrary rules for the inspection of lumber can be maintained with satisfaction. The variations from any given rules are numerous and suggested by practical common sense, so nothing more definite than the general features of different grades should be attempted by written rules of inspection.

Lumber must be accepted on grade in the form in which it was shipped. Any subsequent change in manufacture or condition will prohibit a reinspection for the adjustment of claims except with the consent of all parties interested.

Inspection of lumber is not an exact science and a reasonable variation of opinion between inspectors should be recognized; therefore, a variation of not more than 5 per cent from reinspection should not disturb the original inspection.

Bevel and bungalow siding thicknesses as shown herein, are, by reason of methods of resawing, subject to variation of $\frac{1}{16}$ of an inch.

Bungalow or colonial siding is furnished both in separate length bundles and "new bundling" which contemplates tying short pieces in bundles with long, but the percentage of short lengths or stock under 10 feet shall not exceed 30 per cent.

Bundling—Bevel siding is tied in bundles 10 feet or longer, both odd and even lengths, ten layers to the bundle, three being composed of short lengths, 3 to 9 feet, seven being full-length pieces.

Natural shrinkage means an approximate shrinkage from green to seasoned sizes of 4 per cent in Douglas fir and 5 per cent in spruce, hemlock, and cedar. All grades milled green are subject to natural shrinkage.

Seasoned lumber shall be construed to mean lumber that is air-dried (AD), or kiln-dried (KD) sufficiently to answer satisfactorily for the purposes or use intended and to be in proper condition for dressing.

If Pacific Lumber Inspection Bureau inspection is required, the buyer's order, or a true copy thereof, shall be placed in the inspector's hands, and the certificate of inspection shall show that inspection has been made in accordance therewith. In complying with this rule, buyer's order may have prices omitted.

SPECIFICATIONS FOR TYPICAL GRADES

Hardwood.

In hardwoods, grades are largely based upon freedom from certain standard defects. These standard defects are as follows:

One knot $1\frac{1}{4}$ inches in diameter.

Two knots not exceeding in extent or damage one $1\frac{1}{4}$-inch knot.

One split equal in length in inches to the surface measure of the piece in feet and diverging not more than 1 inch to a foot in length.

Wane 1 inch wide, one-sixth of the length of the piece along the edge, or its equivalent at one or both ends.

Worm, grub, knot, and rafting-pin holes, not exceeding in extent or damage one $1\frac{1}{4}$-inch knot.

The standard grades of hardwood lumber are firsts, seconds, selects, No. 1 common, No. 2 common, No. 3 common, and other grades mentioned under the caption of the respective woods. Firsts and seconds

are combined as one grade, and the percentage of firsts in the combined grade shall not be less than the following: Poplar, 50 per cent; Philippine mahogany, 40 per cent; African and Mexican mahogany, 35 per cent; tupelo, sycamore, white ash, plain oak, chestnut, red gum, sap gum, black gum, cottonwood, magnolia, locust, hackberry and willow, 33⅓ per cent; cherry, beech, soft elm, buckeye, quartered oak, quartered gum, 25 per cent; hard maple, soft maple, birch, black ash and basswood, 20 per cent.

Firsts and Seconds. (Standard Grade)

Lengths are 8 to 16 feet, admitting 20 per cent under 12 feet and 10 per cent of 8- and 9-feet lengths. Widths are 6 inches and up. The number of defects admitted in any piece must be determined from the poor face. Heart center, where the extent or damage does not exceed the equivalent of standard defects allowed, will be admitted. Six inches of straight split in one end or its equivalent in both ends, will not be considered a defect. Splits in excess of the equivalent of two standard defects will not be admitted. In any series of special widths sold 10 inches or wider, splits in excess of the equivalent of one standard defect will not be admitted. Wane along the edge not exceeding one-sixth the length of the piece, or its equivalent at one or both ends, not exceeding in thickness one-half the thickness of the piece, and not exceeding in width as shown in the following table shall not be considered a defect:

½ inch in width in ½-inch to ¾-inch lumber.
¾ inch in width in 1-inch to 2-inch lumber.
1 inch in width in 2½-inch and thicker lumber.

Firsts.—Pieces 4–9 feet surface measure must be clear. Pieces 10–15 feet surface measure may have one standard defect or its equivalent. Pieces 16 feet and over surface measure may have two standard defects or their equivalent.

Seconds.—Standard defects will be admitted according to surface measure as follows:

5 feet, one standard defect or its equivalent.
8 feet, two standard defects or their equivalent.
12 feet, three standard defects or their equivalent.
16 feet, four standard defects or their equivalent.
20 feet, five standard defects or their equivalent.

Specifications of firsts and seconds grade vary with the different species. For example, in plain white and red oak, plain red gum, cherry, etc., this grade conforms to this standard, but in some other species, as yellow poplar, mahogany, etc., the best grade (firsts and seconds) calls for other specifications.

Douglas Fir.

The specifications for representative grades of Douglas fir are as follows:

Finish K.D.

No. 2 Clear and Better.—Flat grain and, or vertical grain, based on 1 by 8 inches by 12 feet. Rule to apply proportionately on narrower or wider and thicker stock. Will admit of slight roughness in dressing; will allow straight splits on the ends not longer than the width of the piece and not to exceed 5 per cent of pieces shipped, or a small amount of stain on the reverse side of the piece. In addition to one of the above, three small pitch pockets, each not to exceed 2 inches in length and not extending through the piece will be allowed; or the equivalent of combined defects.

Dimension Plank and Small Timber

Selected Common.—Shall be sound, strong lumber, well manufactured and free from defects that materially impair the strength. Must be free from shake, loose, encased or rotten knots. Will allow occasional variation in sawing; a slight amount of sap stain; sound and tight, small and standard knots, and pitch pockets not over 6 inches in length. Stock 12 inches and wider may contain in addition to the above, a couple of large knots not to exceed 2 inches in diameter, when well placed.

No. 1 Common.—Must be sound stock, well manufactured, suitable and of sufficient strength for all ordinary building purposes. Will allow sound and tight knots

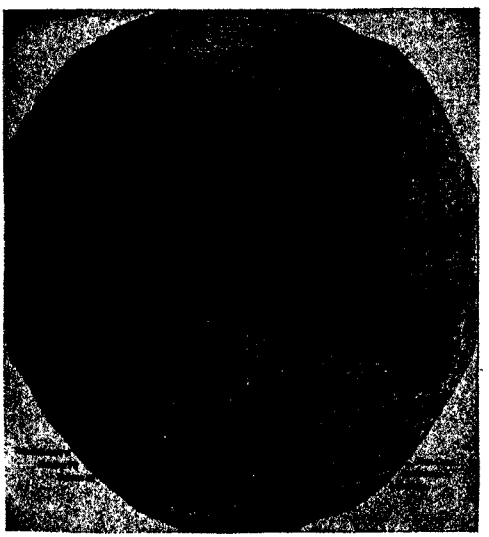


FIG. 21.—Cross-section of a 42 inch Douglas fir log 325 years old showing representative sawing into various grades and sizes suitable for many purposes. (Photograph by West Coast Lumbermen's Association.)

in size from 1½ inches in a 2 by 4-inch varying according to the widths of the piece to a maximum size of 3 inches in 12 inches and wider; spike knots that do not materially weaken the piece; encased knots, varying according to the width of the piece, but not to exceed 2 inches in diameter in 12 inches and wider; wane not over one-fourth the thickness of the piece, 1 inch wide on face up to and including 6-inch widths and 1½

inches wide on face of 8-inch and wider, extending not more than one-third the length of piece or a proportionate amount for a shorter distance on both edges; a limited amount of sap stain and or heart stain; pitch streaks; pitch pockets; seasoning checks; split ends not longer than the width of piece; a limited number of small worm holes; edge defects that are not of a serious nature. West Coast hemlock permitted in 4- and 6-inch widths.

Timbers

Selected Common.—Shall be sound, strong, lumber, well manufactured and free from defects that materially impair its strength; must be free from shake, splits, loose or rotten knots. Will allow sound and tight knots, if not in clusters, and which in no case shall exceed in diameter one-sixth the width of the face in which such knots occur up to and including 12×12; and further providing that such sound and tight knots in 14×14 and larger shall in no case exceed 2½ inches in diameter. Will allow occasional variation in sawing; wane not to exceed 1 inch on one corner and not exceeding one-sixth the length of the piece.

No. 1 Common.—4×4 and wider, 6×6 and larger shall be sound stock, well manufactured and free from defects that will materially weaken the piece. Occasional slight variation in sawing will be allowed. Timbers 10×10 in size may have 2-inch wane on one corner or the equivalent on two or more corners. Smaller and larger timbers may have wane in proportion. In addition will allow: Large, sound and tight knots which approximately should not be more than one-fourth the width in diameter of any one side in which they may appear; spike knots; checks and season checks not extending over one-eighth the length of the piece; stained sap one-third the width and slight streak of heart stain extending not more than one-fourth the length of the piece.

Southern Yellow Pine.

Flooring

"B" flat flooring will admit any two of the following or their equivalent of combined defects; 5 per cent sap stain, 15 per cent firm red heart; three pin knots, one standard knot, three small pitch pockets, one standard pitch pocket, one standard pitch streak, slight torn grain, small seasoning checks.

Edge grain flooring shall take the same inspection as flat grain, except as to the angle of the grain.

No. 1 common dimension and heavy joists will admit sound knots, none of which in 2×4's should be larger than 2 inches in diameter on one or both sides of the piece, and on wider stock which do not occupy more than one-third of the cross-section at any point throughout its length, if located at the edge of the piece, or more than one-half of the cross-section if located away from the edge; pith knots, or smaller defective knots which do not weaken the piece more than the knot aforesaid; will admit of seasoning checks; firm red heart, heart shakes that do not go through, want ¼ of an inch deep on edge, one-fourth the width and one-third the length of the piece; pitch, sap stain, pitch pockets, splits in ends not exceeding in length the width of the piece, a limited number of small worm holes well scattered; may contain crook of 1½ inch in 2×4—16 feet and and ½ inch less in each additional 2 inches in width up to and including 2×12—16 feet. Lengths longer or shorter than 16 feet of No. 1 common dimension may contain crook in proportion to above, and such other defects as do not prevent its use as substantial structural material.

No. 1 Common Timbers

May be either dense or sound pine. Unless otherwise specified this grade will admit any amount of sapwood. Common timbers, rough, 4×4 and larger, may be ¼-inch scant in either or both of its dimensions, shall be well manufactured and may have 1½-inch wane on one corner one-third the length of the piece, or its equivalent on two or more corners, the wane measured on its face. Timbers 10×10 in size may have 2 inches wane as above; the larger sizes may have wane as above in proportion to sizes. Common timbers may contain sound knots and pith knots, provided that the diameter of any one knot shall not exceed the following in size.

2 inches in 4× 4 to 6× 6.
2½ inches in 6× 8 to 8×10.
3 inches in 10×10 to 10×12.
4 inches in 14×14 to 14×16.
4½ inches in 16×16 to 16×18.

In sizes not mentioned the diameter of knots admissible will increase or decrease in proportion to the size of the timbers on the same basis as above specified.

In determining the size of knots, mean or average diameter shall be taken, or the equivalent of the above in grouped knots at any one point. Will admit shakes extending one-sixth of the length of the piece, round or ring shakes, unsound knots 1½ inch or less in diameter, a limited number of pin-worm holes, well scattered, sap stain and seasoning checks. Unless otherwise specified, this grade will admit any amount of sap stain.

Density Rule

Dense southern yellow pine shall show on either end an average of at least six annual rings per inch and at least one-third summerwood, or else the greater number of the rings shall show at least one-third summerwood, all as measured over the third, fourth, and fifth inches of a radial line from the pith. Wide-ringed material excluded by this rule will be acceptable, provided that the amont of summerwood as above measured shall be at least one-half.

The contrast in color between summerwood and springwood shall be sharp and the summerwood shall be dark in color, except in pieces having considerably above the minimum requirement for summerwood.

In cases where timbers do not contain the pith, and it is impossible to locate it with any degree of accuracy, the same inspection shall be made over 3 inches in thickness and on the second inch (on the piece) nearest to the pith in timbers 3 inches or less in thickness.

In dimension material containing the pith but not a 5-inch radial line, which is less than 2×8 inches in section or less than 8 inches in width, that does not show over 16 square inches on the cross-section, the inspection shall apply to the second inch from the pith. In larger material that does not show a 5-inch radial line the inspection shall apply to the 3 inches farthest from the pith.

The radial line chosen shall be representative. In case of disagreement between purchaser and seller the average summerwood and number of rings shall be the average of the two radial lines chosen.

Sound southern yellow pine shall include pieces of southern pine without any ring or summerwood requirement.

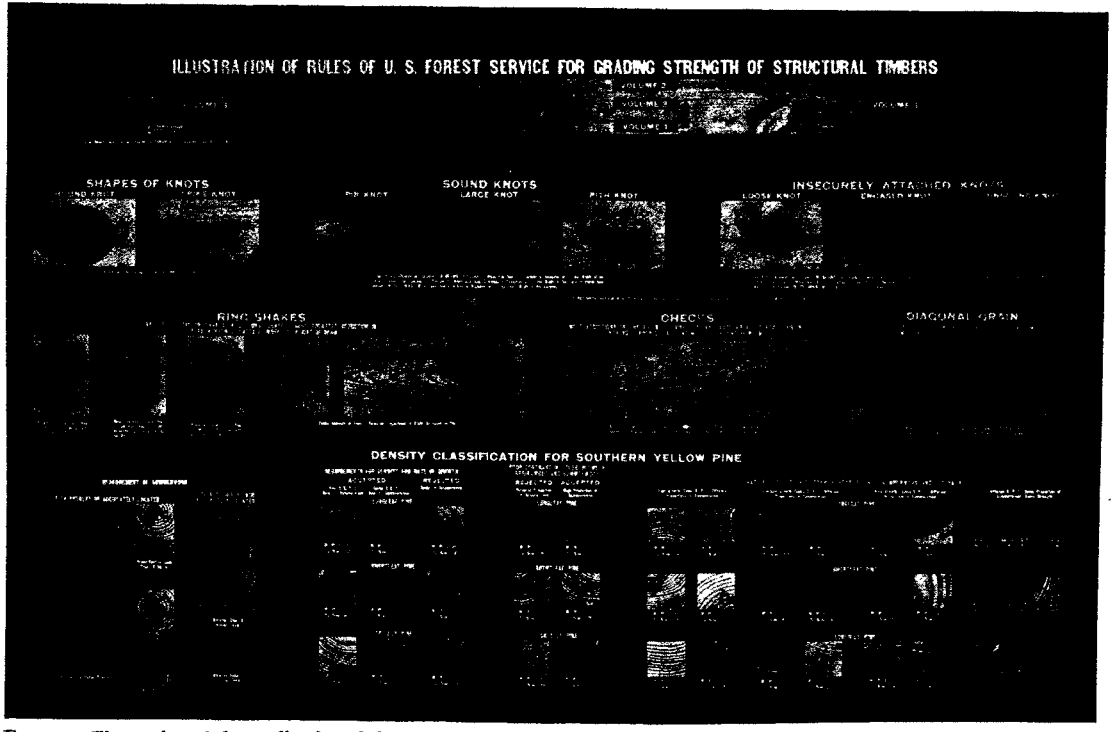


FIG. 22.—Illustration of the application of the density rule in grading southern yellow pine. Also a number of defects important in grading structural timbers. (Courtesy of U. S. Forest Service.)

PERCENTAGE OF DIFFERENT GRADES PRODUCED

It is a familiar axiom in the industry that the higher grades must carry the burden of the lower grades. Otherwise expressed, the higher grades must be sold at a price sufficiently high to make up the losses incurred in marketing the lower grades. As an exceedingly small percentage of the total output belongs to the higher grades, the latter must bring very high prices.

Many of them are really sold at prices out of proportion to their intrinsic values in comparison with the lower grades. The habit of demanding the best is characteristic of the American public and is responsible for this anomalous condition.

For example, when firsts and seconds 4/4 white oak is selling in a given market for $120 per MBF, No. 1 common grade of the same thickness is frequently sold for only $80 per MBF and No. 2 common for only about $40. This is obviously an unreasonable disparity between the better and the lower grades.

The following table shows the percentages of grades cut from Douglas fir and is based upon the output of a large number of mills within the West Coast Lumbermen's Association over a considerable period of time.

PERCENTAGE OF DOUGLAS FIR GRADES

Item.	Total Per Cent to Log.	Per Cent Items to All Clear.	Per Cent to All Common.
Flooring V. G. clear	3.8	13.8	
Flooring S. G. clear	3.3	13.0	
Finish clear	5.5	21.0	
Ceiling clear	4.3	16.4	
Drop siding clear	5.8	21.8	
Car material	4.4	7.1	3.1
Shop	.5	1.9	
Silo, battens, clear	1.3	5.0	
Boards	21.3	.....	28.9
Dimension	25.2	.....	34.5
Planks and small timbers	8.1	.....	11.4
Timbers	13.0	.....	17.5
Ties	2.6	.....	3.5
Mining	.5	.....	.7
Miscellaneous	.4	.....	.4
Totals	100.0	100.0	100.0

The following table shows the percentage of grades produced from red gum logs of different diameters. This shows conclusively how large a percentage of the upper grades is produced from large logs as compared with small logs. It shows the products of both red gum and sap gum and is based upon a study made at a large band mill in Mississippi.

AVERAGE LUMBER GRADES PRODUCED FROM RED GUM

	Logs 12 to 18 Inches Diameter, Average 16 Inches. Per Cent.	Logs 17 to 20 Inches Diameter, Average 18.7 Inches. Per Cent.	Logs 21 to 26 Inches Diameter, Average 22.6 Inches. Per Cent.	Logs 26 Ins. and up in Diameter, Average 30.4 Inches. Per Cent.	Logs 12 to 36 Inches Diameter, Average 21.9 Inches. Per Cent.
F. A. S., red.....	2.19	1.14	5.03	20.42	7.19
No. 1 common, red.	5.64	8.92	14.52	10.21	9.83
Box boards.....	2 87	1.47	5.83	8.87	4.76
F. A. S., sap.....	11.43	26.60	38.35	37.92	28.57
No 1 common, sap..	25.42	23.57	15.35	6.97	17.83
No. 2 common, sap.	33.17	24.37	11.12	8.90	19.39
No. 3 common, sap.	19.28	13.93	9.80	6.71	12.43

The following table shows the percentage of grades produced from six principal species cut in the Inland Empire by mills of the Western Pine Manufacturers' Association in Idaho and eastern Washington and Oregon. It is taken from data prepared by D. T. Mason and published by the Association.

LUMBER GRADES PRODUCED IN THE INLAND EMPIRE

Lumber Grades.	Species.					
	Idaho White Pine. Per Cent.	Western Yellow Pine. Per Cent.	Western Larch. Per Cent.	Douglas Fir. Per Cent.	White Fir. Per Cent.	Western Red Cedar. Per Cent.
Select.....	14	10.0	3.0	3.0	.....	3
Shop.....	2	22.0				
No. 1 common.....	12	0.4	3.0	3.0		
No. 2 common.....	29	19.0				
No. 3 common.....	26	39.0	14.0	14.0	92	97
No. 4 common.....	12	8.0	4.0	4.0	8	
No. 5 common.....	2	0.3	.....	.....		
Miscellaneous.....	3	1.0	76.0	76.0		

The following table shows the average percentage of each grade of northern pine lumber, according to the Northern Pine Manufacturers' Association, for the two five-year periods, 1912–1916 and 1917–1921, inclusive.

	1912–6. Per Cent.	1917–21. Per Cent.
Dimension		
No. 1 common	20.30	14.00
No. 2 common	3.82	3.01
No. 3 common	.92	1.32
Common Boards and Strips		
No. 1	4.80	2.65
No. 2	13.44	9.87
No. 3	19 72	22.98
No. 4	10 16	15.c4
No. 5	6.46	7.83
Inch Selects		
D and better	6.86	5.27
C and better Norway	1.94	1.08
Thick Finish		
D and better	2.30	2.34
C and better Norway	.66	.70
No. 1, 2 and 3 shop	2 40	2 21
Select common and tank	.54	1.10
Thick Common		
No. 1 common	.32	.68
No. 2 common	.80	3.66
No. 3 common	1 40	3.66
No. 4 common	1.08	2.49
No. 5 common	.48	1.19
Short Box Lumber		
No. 4 and better	1.60	1.28
	100.00	100.00

INSPECTION

Lumber is generally inspected and graded when green, at the rear of the sawmill, as it comes from the trimmer saws. At this time some identifying mark is placed on the face side near one end, and all lumber of the same grade, species, and size is separated from other pieces and

piled together. This inspection gives a check on the initial output of the sawmill; but in the process of seasoning, either by air-drying or by kiln-drying, considerable degrading occurs, principally through checking. Other conditions tending to degrade stock are sap stain, warping, twisting, and other defects incident to proper curing.

After lumber has been seasoned, either naturally or artificially, it is always graded again before shipment. At the same time, a careful count and piece tally are made, so that the manufacturer will have an accurate record of the grade and measure of stock which he has shipped.

On arrival at destination, it is also customary for the buyer to regrade the stock as unloaded from the cars, in order to have a check on both the grade and count of the shipper. Naturally, the results of this inspection do not always agree with those of the inspection at the mill, and disputes are likely to arise unless both parties have made a pre-arrangement to accept the certified inspection as given by some well-recognized organization.

In case of disputes over inspection, it is customary to agree upon a third inspection, the costs of handling and re-inspection to be charged to the one who has been in error. Sellers generally insist on a maximum of five days after arrival of car, within which period consignee or buyer can make complaint regarding grade, condition, or count; and in all cases stock from the car in question must be kept intact and separate from any other lumber at point of unloading. It is customary, in some markets, however, to permit 5 per cent of the total contents of the shipment to be off grade. This custom recognizes the impossibliity of grading every single board on a hard-and-fast basis. An allowance of 5 per cent has, therefore, been considered reasonable in the past.

INSPECTION CERTIFICATES AND THEIR SIGNIFICANCE

Owing to the frequent occurrence of disputes over inspection, there has been built up, within certain organizations, a standardized system of inspection by specially qualified persons.

In the export trade and in the domestic hardwood business, the inspection certificates of the National Hardwood Lumber Association have attained considerable credence, standing, and common acceptance, as a result of the efficiency, fairness, and honesty of the inspection service. It is becoming increasingly the custom for both shippers and buyers of hardwood to accept the inspection certificate of this association as final. These certificates can only be obtained by members of

the association; but they can be given by members of the association to non-members, and non-members can secure the benefits of this inspection by purchasing from members of the association. The National Hardwood certificate attached to documents has therefore obtained considerable significance in both the export and domestic trade and has contributed very materially to the building up of better ethics and understanding between buyer and shipper.

The certificates issued by the Pacific Lumber Inspection Bureau, on the West Coast, are equal in significance and importance to those issued by the National Hardwood Association, which covers the

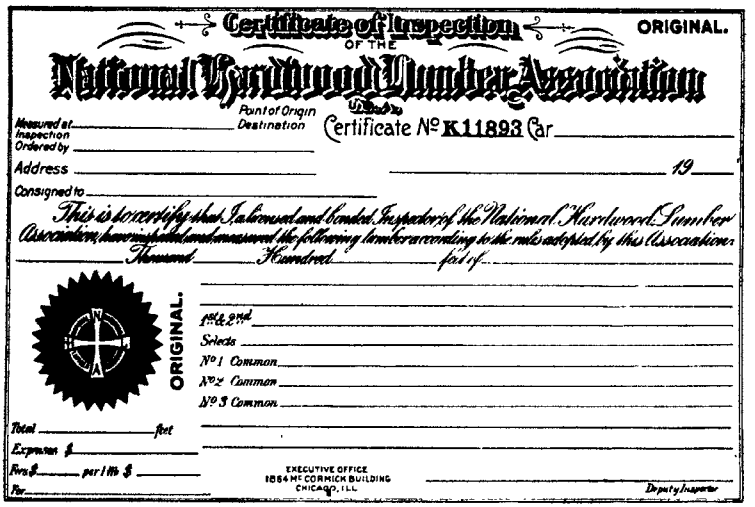

Certificate of Inspection ORIGINAL.
OF THE
National Hardwood Lumber Association
Point of Origin
Measured at Destination Certificate No K11893 Car
Inspection
Ordered by
Address 19
Consigned to
This is to certify that I, a licensed and bonded Inspector of the National Hardwood Lumber Association, have inspected and measured the following lumber according to the rules adopted by this Association:
Thousand Hundred feet of
ORIGINAL.
1st & 2nd
Selects
No 1 Common
No 2 Common
No 3 Common
Total feet
Expenses $
Rate $ per M ft $
For
EXECUTIVE OFFICE
1564 McCORMICK BUILDING
CHICAGO, ILL.
Deputy Inspector

FIG. 23.—Form of inspection certificate issued by the National Hardwood Lumber Association covering shipments made for both domestic and foreign destinations.

hardwood trade. The Pacific Lumber Inspection Bureau is an organization maintained separately from other organizations, to give a fair and unbiased survey and count of both export and domestic shipments. Many foreign buyers of Douglas fir have come to recognize the value and significance of the certificate of this Bureau, just as buyers of hardwood in the United Kingdom and elsewhere have come to accept the National Hardwood certificate.

The inspection certificates issued by the Southern Pine Association have attained considerable standing and importance in the trade, because the members of the inspection department of this association have built up a reputation for fairness, honesty, and unbiased opinion.

These inspectors have settled a great many disputes, not only within the association, but between organizations and individuals entirely removed from its activities.

Pacific Lumber Inspection Bureau, Inc.

LUMBER INSPECTOR'S CERTIFICATE

_____

We / I { _____ } _____ regularly approved Lumber Inspector..., licensed by the Pacific Lumber Inspection Bureau, Inc., and at the time acting in that capacity, do hereby certify that We / I have personally tallied and inspected, according to the grading and survey rules as per _____ adopted by the West Coast Lumbermen's Association, the cargo of lumber shipped on board the _____

by _____ bound for _____

and the said cargo has been shipped in good order and condition and consists of:

COPY

PACIFIC LUMBER INSPECTION BUREAU 1916

_____ } Inspector...

Subscribed and sworn to before me, the undersigned, a Notary Public in and for the _____ by the above named part... _____ personally known to me as the person... signing the above certificate.

_____ Notary Public.

This Certificate is not valid unless signed by one of the Pacific Lumber Inspection Bureau, Inc., commissioned by one of its members and has four identifications.

Countersigned: _____ Supervisor. Dated _____ 19 ...

FIG. 24.—Form of inspection certificate used in shipping a large percentage of both foreign and domestic movements of West Coast fir, hemlock, cedar, etc.

Nearly all lumber manufacturers' associations maintain inspectors at the principal points of consumption of their products, and in this way protect not only their members, but the interests of their markets as well.

The inspectors of the National Hardwood Association may be found at most of the producing and consuming points for hardwoods.

It is becoming customary for buyers and shippers to agree upon the inspection of a certain organization or association as final and to state this agreement on orders. This tendency has undoubtedly created a much finer and higher standard of business ethics within the industry. The confidence of banking institutions in certain inspection certificates has become established and these certificates have attained the same recognition in many transactions as the warehouse receipt has in the grain business.

Great care is generally exercised to insure refusal of certificates whenever an attempt is made by representatives of either the buyer or the seller, to dictate to inspectors or to influence them in any way.

CHAPTER VII

SIZES

EARLY DEVELOPMENT IN SIZES

THROUGHOUT the early stages of development of the American lumber industry, there was a total lack of uniformity in the rough and finished sizes of lumber and timbers. Each mill commonly set its headblocks to suit its own particular trade and favored customers. In some cases 1-inch lumber was cut full to dress down to 1 inch. Then 4/4 lumber was cut green 1 inch full, and dressed one side to $\frac{7}{8}$ or two sides to somewhat less. If a buyer purchased lumber from two different mills he was often unable to match up lumber. either in the rough or finished sizes.

This practice naturally resulted in considerable confusion, much of which was obviated by the adoption, during the period of 1890 to 1900 and shortly thereafter, by the various manufacturing associations, of standard sizes of lumber and timber in both rough and dressed conditions. As decisions were made according to the demands of the market, there is no uniformity whatever among the different woods, or even among various producing regions of the same species, for example, yellow pine. At the present time, as shown in a later chapter, there is an entire lack of uniformity and a growing disposition throughout the industry to standardize not only names of species and grades but also the number of the grades and finished sizes of lumber, both rough and dressed.

LIMITATIONS OF FOREST AND MARKET

With the expansion of the lumber industry to all sections of this country, it was found that the limitations of size, in both height and dimension of the trees, had an important influence upon the possibilities of manufacture. This factor combined with the demands of the market, very largely controlled the shapes and form of the product which could be merchandised with the greatest efficiency and highest profit.

ROUGH AND FINISHED SIZES

Lengths.

Hardwood is cut to the following lengths: 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, and 16 feet, in odd and even lengths. However, not over 15 per cent of odd lengths are admitted in any grade, and in the best grade, namely firsts and seconds, only lengths of 8 to 16 feet are admitted, with not over 20 per cent under 12 feet and not over 10 per cent of 8- and 9-foot lengths.

Softwood lengths, on the other hand, are cut customarily only in multiples of 2 feet, beginning at 4 or 6 feet or more, except for the export trade in which odd as well as even lengths are accepted. The principal lengths are 14 and 16 feet, depending upon the species, but lengths of 10 feet and up are commonly marketed. Except in the case of Douglas fir, logs are generally cut from 10 feet to 16 feet with as many 16-foot lengths as possible. In all softwoods, logs intended for timbers and dimension are cut longer than 16 feet.

In the Douglas fir region, with the rapid removal of timber closely accessible to the mills, many logs have been brought to the sawmills by rail, and as freight rates on logs are high and minimum carload rates unreasonably large, most of the cars are loaded to capacity and a large percentage of Douglas fir, and other west coast logs produced on the same operations, are cut in 40-foot lengths. The reason for this is that the mills are most economically supplied with maximum carload lots, and with modern logging machinery a 40-foot log can be handled in the woods and loaded on cars almost as cheaply as a log of shorter length. The percentage of logs of each length produced on the average Douglas fir operation is about as follows:

40 foot lengths.....				60	per cent
32	"	"	.....	15	"
36	"	"	.....	10	"
24	"	"	.....		
26	"	"	.....		
30	"	"	.....	15	"
34	"	"	.....		
38	"	"	.....		
			Total	100	"

Furthermore, Douglas fir up to 24×24 inches and up to 120 feet long can be commonly manufactured; also 40×40 inches—80 feet and 60×60

inches—50 feet, whereas in southern yellow pine sizes over 16×16 inches ×45 feet long are exceptional. The limitations of the largest virgin trees do not permit of cutting sizes larger than this, except in unusual instances.

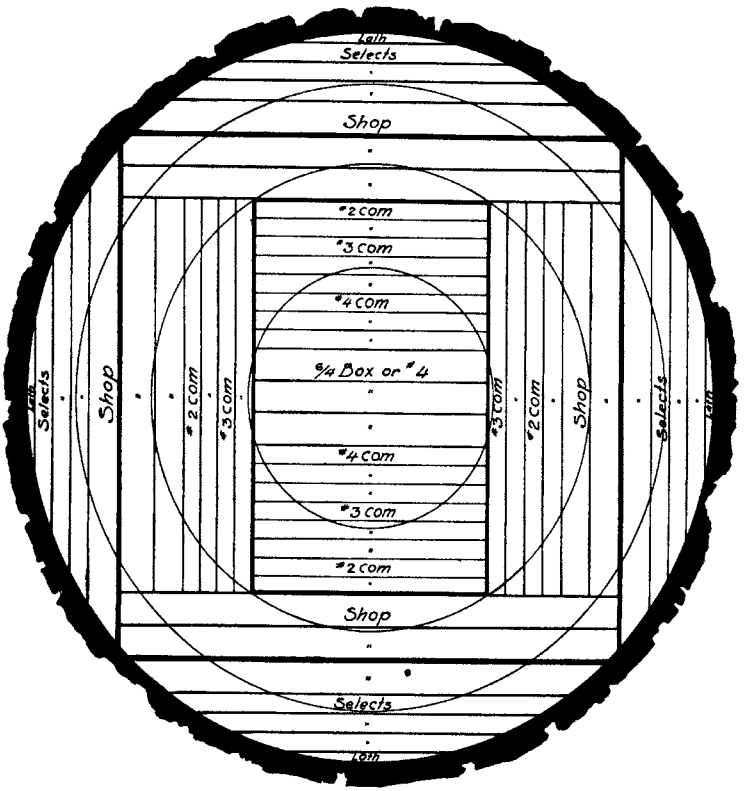


FIG. 25.—Diagram showing how a typical western soft pine log is sawed into the various sizes and grades. The best lumber is generally found just inside the bark and conversely the most defective at or near the pith.

In the case of other woods, such as North Carolina pine, hardwoods, and cypress, it is exceptional to purchase lengths over 16 feet and orders calling for random lengths, 10 to 16 feet are much preferred to those calling for specified lengths.

With southern yellow pine it is customary to charge $1 per thousand board feet for every 2 feet over 20 feet. In this species, timbers are commonly sold by the cubic average, that is, the actual cubic foot con-

tents of the average piece. For example, a timber 12×12 inches—30 feet long would contain 30 cubic feet and would be said to be of 30 cubic average. As smaller sizes are cut, greater lengths must be produced to bring up the average to a stated amount. Thirty-five cubic average is considered a large average in southern yellow pine, and a cubic average of less than 25 is seldom used.

Widths.

Hardwoods are generally sold 3 inches and up in width and softwoods 4 inches and up. Both odd and even widths are accepted in the hardwood trade, whereas only even widths are generally acceptable in the domestic softwood trade. In the export trade both odd and even widths, as well as lengths, are acceptable. In the softwood trade widths are generally 6 inches or more. Widths of 6 inches and less are generally called strips. If average widths of 9 inches or over are called for on orders, there is generally an added price, except in lumber originating in large-sized trees, such as western pine, redwood, Douglas fir, western hemlock, etc.

In cypress, red and sap gum, and yellow poplar, it is possible to secure widths up to 16 to 20 feet or more, but when these are demanded in the highest grade a proportionately high price is charged.

Prices of lumber are very often in direct proportion to width above a certain stated size, which varies with each species. Narrow widths in Douglas fir and some other large west coast woods are often more expensive than wider ones, on account of the loss of wood and expense in manufacture.

Sizes of dressed widths are shown in connection with dressed thicknesses.

Thicknesses.

The standard thicknesses of softwoods in the rough are as follows: 4/4, 5/4, 6/4, 8/4, 10/4, 12/4 inches, etc., up to the limitations for timbers in each species. Special orders in the rough may call for 3/8, 1/2, 5/8, 3/4, and 7/4-inch thicknesses.

The standard thicknesses of hardwood lumber are shown below:

In the chapter on Grading Rules, a fuller description is given regarding the cutting of rough stock.

There is a great lack of uniformity in the thicknesses of 4/4 boards dressed to flooring, ceiling, finish and other sizes, as shown in the follow-

ing table. This is a result of customs built up in the handling of individual species, without regard to other or competing species. The practice in sawing 4/4 yellow pine lumber is that it must be sawed in the rough to sufficient thickness to dress down to 13/16.

The standard thicknesses of rough and dressed hardwood lumber, including flooring, are as follows:

Thickness, Rough.	Thickness, Dressed.
$\frac{3}{8}$ inch S2S	to $\frac{5}{16}$ inch
$\frac{1}{2}$ " "	" $\frac{6}{16}$ "
$\frac{5}{8}$ " "	" $\frac{7}{16}$ "
$\frac{3}{4}$ " "	" $\frac{9}{16}$ "
1 " "	" $\frac{13}{16}$ "
$1\frac{1}{4}$ " "	" $1\frac{3}{32}$ "
$1\frac{1}{2}$ " "	" $1\frac{1}{32}$ "

For all thicknesses over $1\frac{1}{2}$ inches in even and half inches up to 6 inches the allowance for dressing hardwoods is $\frac{1}{4}$ inch below the nominal thickness. Lumber surfaced on only one side must be $\frac{1}{16}$ inch above all these sizes.

The standard thickness for inch flooring in most softwoods, such as white and Norway pines, southern pine, including longleaf and shortleaf, North Carolina pine, Douglas fir, cypress, and hemlock is $\frac{13}{16}$ inch. Inch flooring, as produced by the Western Pine Manufacturers' Association, including Idaho white pine, western soft pine, Douglas fir and larch, is dressed to $\frac{3}{4}$ inch and the 4-inch width is dressed to $3\frac{1}{8}$ inches. The face of softwood flooring varies considerably however. In longleaf and shortleaf 3-inch flooring is frequently dressed standard to $2\frac{3}{8}$ inches, while some mills dress to $2\frac{1}{4}$ and $2\frac{1}{2}$ inches face, depending upon the custom of the local market; North Carolina pine flooring is dressed to $2\frac{1}{2}$ inches face and Douglas fir and cypress to $2\frac{1}{4}$ inches face; other softwoods are not made in 3-inch flooring. The uniformity in 4-inch flooring dressed to $3\frac{1}{4}$ inches is the same in white and Norway pine, longleaf and shortleaf pine, Douglas fir, western hemlock, and cypress, but North Carolina pine is dressed to $3\frac{1}{2}$ inches face. In 1×6-inch flooring, longleaf, shortleaf, white and Norway pine, cypress, and eastern hemlock are dressed to $\frac{13}{16}\times5\frac{1}{4}$ inches, whereas the face of Douglas fir, western hemlock, Idaho white pine, western larch, and western soft pine is $5\frac{1}{8}$ and that of North Carolina pine is $5\frac{1}{2}$ inches. Thus 6-inch flooring is worked to $5\frac{1}{8}$, $5\frac{1}{4}$ and $5\frac{1}{2}$ in different woods.

STANDARD SIZES OF DRESSED SOUTHERN YELLOW PINE

Nominal Size in inches.	Finished Size in inches.	Standard Lengths in feet.
	FLOORING	
1×3, 4 and 6	$\frac{13}{16}$×2$\frac{1}{2}$, 3$\frac{1}{2}$ and 5$\frac{1}{2}$	4–20
5/4×3, 4 and 6	$1\frac{1}{16}$×2$\frac{1}{2}$ and 2$\frac{1}{2}$, 3$\frac{1}{2}$ and 5$\frac{1}{2}$	4–20
6/4×3, 4 and 6	$1\frac{5}{16}$×2$\frac{1}{2}$ and 2$\frac{1}{2}$, 3$\frac{1}{2}$ and 5$\frac{1}{2}$	4–20
	CEILING	
$\frac{3}{4}$×3, 4 and 6	$\frac{25}{32}$×2$\frac{1}{2}$, 3$\frac{1}{2}$ and 5$\frac{1}{2}$	4–20
$\frac{3}{4}$×3, 4 and 6	$\frac{7}{16}$×2$\frac{1}{2}$, 3$\frac{1}{2}$ and 5$\frac{1}{2}$	4–20
$\frac{3}{4}$×3, 4 and 6	$\frac{29}{32}$×2$\frac{1}{2}$, 3$\frac{1}{2}$ and 5$\frac{1}{2}$	4–20
$\frac{3}{4}$×3, 4 and 6	$\frac{11}{16}$×2$\frac{1}{2}$, 3$\frac{1}{2}$ and 5$\frac{1}{2}$	4–20
	FINISH, S1S or S2S or S2E	
1×4, 5, 6, 7 etc., to 12	$\frac{13}{16}$×$\frac{1}{4}$″ scant in all sizes, etc., 12″ which is $\frac{3}{4}$″ scant (all rough finish or D1S or D2S not more than $\frac{1}{4}$″ scant on 8″ widths and $\frac{3}{8}$″ on 9″ and 10″ or $\frac{1}{2}$″ on 11 or 12″″ or wider)	4–20
5/4, 6/4 and 8/4 thickness S4S	1$\frac{1}{16}$, 1$\frac{5}{16}$, 1$\frac{3}{4}$ by same width as 1 inch	4–20
	DIMENSION, S1S1E	
2×4, 6, 8, 10, 12	1$\frac{5}{8}$×3$\frac{5}{8}$, 5$\frac{5}{8}$, 7$\frac{1}{2}$, 9$\frac{1}{2}$, 11$\frac{1}{2}$, when S4S, $\frac{1}{4}$″ less in S&E is allowed	10–24 in multiples of 2. Lengths of 4–10 may be shipped by special agreement
3×10, 12 and 14 green when green rough may be $\frac{1}{4}$″ off in width or thickness	$\frac{1}{4}$ off 1S, $\frac{1}{4}$ off 1E when S4S $\frac{1}{4}$ off each face	
	TIMBERS	
6×6 and up	$\frac{1}{4}$ off for each face surfaced	8–20 or longer in multiples of 2 feet when lineal average is specified odd and even feet are allowed

The same lack of uniformity exists among the various species with respect to the finished sizes in ceiling, partition, siding, finish, sheathing, etc. The location, size, and depth of the tongue and groove varies with the different woods. Consequently, until sizes and grades are standardized, buyers and sellers of lumber must be thoroughly acquainted with the grading rules and the specifications of rough and finished sizes of

STANDARD SIZES OF DRESSED DOUGLAS FIR

Nominal Size in inches	Finished Sizes in inches	Standard Lengths in Feet
	FLOORING K.D.	
1×3, 4 and 6 V.G.	$\frac{13}{16}$×2½, 3½ and 5½	6-16 in multiples of 1 foot
1×4 and 6 F.G.	$\frac{13}{16}$×3½ and ¾×5½	6-16 in multiples of 1 foot
1¼×3, 4 and 6	$1\frac{1}{16}$×2½, 3½ and 5½	6-16 in multiples of 1 foot
1½×3, 4 and 6	$1\frac{5}{16}$×2½, 3½ and 5½	6-16 in multiples of 1 foot
	CEILING K.D.	
⅜×3, 4 and 6	$\frac{5}{16}$×2½, 3½ and 5½	6-16 in multiples of 1 foot
½×3, 4 and 6	$\frac{7}{16}$×2½, 3½ and 5½	6-16 in multiples of 1 foot
⅝×3, 4 and 6	$\frac{9}{16}$×2½, 3½ and 5½	6-16 in multiples of 1 foot
1×3, 4 and 6	$\frac{11}{16}$×2½, 3½ and 5½	6-16 in multiples of 1 foot
	FINISH K.D., S1S or S2S, S1E or S2E	
1×4, 5, 6, 8, 10, 12, 14 and 16	¾×3½, 4½, 5½, 7¼, 9¼, 11¼, 13 and 15	Lengths 6-16 in multiples of 1 foot
	COMMON BOARDS D & M., S1S or S2S	
1×4, 6, 8, 10, 12	¾×3¼, 5⅛, 7, 9 and 11	6-20 in even foot lengths
	DIMENSION PLANK AND SMALL TIMBER, S1S1E or S4S	
2×4, 6, 8, 10, etc.	1⅝×3⅝, 5⅝, 7⅛, 9⅛, etc.	8-32 in even foot lengths
	TIMBERS, S1S, S1E, S1S1E or S4S	
4×14 and wider, 6×6 and up	½ inch off each way	8-40 or longer in even foot lengths

the various species and manufacturing associations, in order to avoid misunderstandings and expensive disputes.

Although the standard dressing of 4/4-inch Douglas fir is ¼ inch, some markets, such as those in Southern California and east of the Mississippi River have insisted on dressing to only $\frac{13}{16}$. This has been possible on water hauls but practically impossible on rail hauls.

Green rough fir is usually cut to the nominal size and in seasoning shrinks somewhat. Natural shrinkage is estimated at 5 per cent.

COMMON BOARD AND DIMENSION MATERIAL SIZES

Sizes at Present (1923) Provided in the Grading Rules of the Associations of Lumber Manufacturers

	1-INCH COMMON BOARDS.		2-inch Dimension.
	S1S	S2S	
Northern Pine Manufacturers' Assn	25/32	25/32	1 9/16
Western Pine Manufacturers' Assn	25/32*	25/32*	1 5/8
	3/4†	3/4†	
California White & Sugar Pine Mfrs. Assn	..	13/16	
Southern Cypress Manufacturers' Assn	13/16	13/16	1 3/4
Hardwood Manufacturers Institute	13/16	13/16	1 3/4
California Redwood Association	..	13/16	1 3/4
West Coast Lumbermen's Association	3/4	3/4	1 5/8
Southern Pine Association	13/16	13/16	1 5/8
Georgia-Florida Sawmill Association	13/16	13/16	1 5/8
North Carolina Pine Association	7/8	13/16	1 5/8
Northern Hemlock & Hardwood Mfrs. Assn	25/32	25/32	1 5/8
Michigan Hardwood Manufacturers' Assn	..	13/16	1 3/4
National Hardwood Lumber Assn	..	..	1 3/4

* Refers to Western White Pine and Idaho White Pine.
† Refers to mixed woods.

Resawing.

The practice of resawing 4/4, 6/4, 8/4, 10/4 and other stock to thinner boards has given rise to considerable complications in the lumber industry. For sawing 6/4-inch hardwoods, one large company sets its carriage head blocks to cut 1 1/16 inches and allows 1/16 inch for shrinkage in this size and 1/8 inch in the case of quarter-sawed stock, with 1/8 inch allowed for saw-kerf. Resawed 6/4 stock should yield pieces 5/8 inch in thickness, but in the case of hardwoods there is generally a larger allowance for shrinkage and for resawing than is the custom with softwoods.

The price of 5/4 resawed stock is generally invoiced to the customer on a true basis; that is, according to one large company's practice, the charges are arrived at in the following way: Add freight and working charges to the price of the lumber at basing point, and to this total add 1/4 and divide by 2. In theory, some companies resaw 6/4 stock so that there will theoretically be two pieces of 13/16-inch, but owing to the inaccuracy of manufacture and the looseness of the machinery, there is always a slight variation.

Hardwood Dimension.

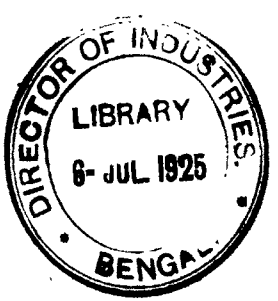
Hardwood dimension refers to small pieces, principally oak, poplar, chestnut, maple, ash, hickory, birch, and beech, used particularly by manufacturers of furniture, toys, bobbins, shuttles, boxes, handles, washboards, wooden ware, kitchen cabinets, musical instruments, clocks, bookcases, etc.

The principal sizes in use are 1×1; 1×1½; 1×2; 1×2½; 1×3; 1×4; 2×2; 2×3; 2×4; intermediate sizes; and larger sizes including pieces 16 to 48 inches or more in length. Clear grades are usually required.

This has been a comparatively recent development in the hardwood lumber industry and offers great advantages over the use of regular hardwood board lumber, because manufacturers receive stock cut to sizes used by them. Therefore, waste is greatly reduced, the production of the finished article is made less expensive, considerable freight is saved in shipping defective lumber not used in the final article, and less space is required in the assembling plant. Furthermore, conservation of our forests is furthered and much material formerly wasted at manufacturing plants is economically utilized.

Hardwood dimension is produced both from No. 1 common and No. 2 common lumber at the sawmills, as well as from green slabs, edgings and trimmed butts. The trimmed butts are generally resawed, ripped, edged and trimmed to the desired finished size and then graded, sorted, and tallied before being placed under covered sheds for air-seasoning. It generally requires from four to five months to dry oak to shipping-dry condition and from three to four months for other hardwoods, depending chiefly upon the thickness.

Many furniture and other woodworking factories are now ordering hardwood dimension stock in carload lots in place of ordering hardwood lumber in No. 1 and No. 2 common and reworking to suit their particular requirements.


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COMPARISON BETWEEN DRESSED SIZES FOR SOME OF THE PRINCIPAL FORMS OF YARD LUMBER RECOMMENDED BY THE FOREST SERVICE, AND THE STANDARDS OF THE REGIONAL MANUFACTURERS' ASSOCIATION AS SHOWN IN PUBLISHED GRADING RULES

Sizes in Use by Various Lumber Manufacturing Associations

Form of Lumber	Sizes Recommended by the Forest Service	Northern Pine Manufacturers' Association	Western Pine Manufacturers' Association	California White and Sugar Pine Mfrs'. Association	West Coast Lumbermen's Association	Southern Pine Association	Georgia-Florida Sawmill Association	North Carolina Pine Association	Southern Cypress Manufacturers' Association	California Redwood Association	Northern Hemlock and Hardwood Manufacturers' Association	Michigan Hardwood Manufacturers' Association
1×8 finish S4S	13/16×7½	25/32×7½	25/32×7⅝	13/16×7¾	¾×7¾	13/16×7½	13/16×7½	13/16×7½	13/16×7½	13/16×7½	25/32×7⅝	13/16×7½
1×6 D&M (face width)	¾×5½	25/32×5½	25/32×5½	13/16×5½	¾×5⅝	¾×5½	¾×5½	¾×5½	¾×5½	13/16×5½	25/32×5½	13/16×5½
1×10 shiplap (face width)	13/16×9½	25/32×9	25/32×9	13/16×9	¾×9	¾×9⅛	¾×9⅛	¾×9⅛	13/16×9	¾×9	25/32×9½	13/16×9½
1×3 flooring (face width)	13/16×2⅜	25/32×2¼	25/32×2¼	.....	13/16×2¼	13/16×2⅜	13/16×2⅜	13/16×2¼	13/16×2¼			
1×6 drop siding (worked shiplap)	¾×5⅛	25/32×5	25/32×5	.....	¾×4⅞	¾×5⅛	½×5	¾×5⅛	13/16×5	13/16×5	25/32×5¼	
2×4 dimension (S1S1E)	1⅝×3⅝	1⅝×3⅝	1⅝×3⅝	1⅝×3⅝	1⅝×3⅝	1⅝×3⅝	1⅝×3⅝	1¾×3¾	1¾×3⅝	1¾×3¾	1¾×3¾	1¾×3¾
2×8 dimension (S1S1E)	1⅝×7½	1⅝×7⅝	1⅝×7½	.....	1⅝×7½	1⅝×7½	1⅝×7½	1¾×7¼	1¾×7⅝	1¾×7½	1¾×7¼	1¾×7⅝

CHAPTER VIII

SELLING AND DISTRIBUTION

DEVELOPMENT

THE business of selling the products of our sawmills is an enormous one in itself. As the centers of production are far removed from the great consuming markets, and as there are over 30,000 separate and distinct manufacturing units literally competing with each other on these markets, the problems of moving lumber to the ultimate point of consumption, either directly or through the medium of wholesaler, middleman, or contractor, are most intricate and complex.

The prime factors which control the movement of lumber to its destination are:

1. The demands of the market for species having certain properties—either for construction, car-building, boxing and crating, etc.

2. Price at point of delivery in competition with species used for similar purposes.

3. Freight rates from the manufacturing plant to the delivery point.

The conditions controlling prices at which mills can afford to sell their product vary greatly. Two mills similarly located, cutting the same kind of lumber and having plants of the same size, may differ vastly in their costs, and therefore in their selling prices. The factors which determine these selling prices from the viewpoint of the mill-owners are:

1. Cost of stumpage.

2. Overhead charges and financing program.

3. Immediate demand for funds.

4. Efficiency of logging and manufacturing operations.

5. Degree of utilization of the raw product.

6. Selling and commission charges and general efficiency, together with the alertness and effectiveness of the credit and traffic departments.

In connection with the fifth point mentioned, it should be noted that the mill using the largest percentage of the contents of the standing trees does not always show the highest percentage of profit on the operation.

Sawmills located from 100 to 1000 miles or more from the point of consumption must compete with portable mills lying on the outskirts of the same markets. In many cases, producers of the same species, located at a distance of 200 miles or more from the point of consumption, must make their F.O.B. mill prices fit in with the transportation charges, in order to compete on certain markets. For example, in the great yellow pine market of St. Louis, lumber shipped from nearby points in Missouri and Arkansas compete with lumber shipped in from Texas, Alabama and Mississippi. In the hardwood markets of Buffalo, local birch, beech and maple from New York compete with the same species shipped in from Wisconsin, Canada, and Michigan. Oak shipped from Arkansas competes with oak from West Virginia, etc.

Lumber is distributed in carload lots of minimum weights fixed by the common carriers and the Interstate Commerce Commission. The maximum carload lots are fixed by the individual car capacity as put into effect by the railroads and the Commission. The cost of shipping lumber in less than carload lots is so excessive as to be practically prohibitive.

Finished lumber, such as ceiling, flooring, kiln-dried stock, shed stock and all upper grades requiring protection from the weather, are shipped in box cars. Green lumber, either rough or dressed, when shipped in box cars during warm weather will stain and rot, arriving in a blackened and nearly worthless condition. This may hold true even on relatively short hauls from points along the south Atlantic Coast to such points as Philadelphia and Baltimore.

Rough lumber, dimension stock and timbers, either rough or dressed, are usually shipped in gondola or flat cars. Mixed carloads are shipped in box cars. This condition does not always obtain in times of car shortage, such as occur, for example, in the grain season and in the early spring building rush. During such times, even logging cars or private freight cars are pressed into service in order to make deliveries according to contract.

At first there were comparatively few mills, small in size, and close to the markets, and the raw material in the form of logs and standing forests was abundant and of good size and quality. Lumber was consequently cheap and the demand was only for clear boards of the highest grades. This naturally involved a tremendous waste and loss of wood in the form of medium and lower grades, which were often unsalable.

There was little competition in those days, and lumber distribution was a simple process. With the cutting of the accessible forests, how-

ever, and the removal of the sources of supply to remote locations, freight charges were steadily increased. With the growth of population and the upbuilding of the great central agricultural regions, white pine became scarce and more expensive and was forced into competition with the cheaper yellow pine from the South and, still later, with the western soft pine, Douglas fir, Idaho white pine, hemlock, and western larch from the Western States.

Now the severest competition exists throughout all the lumber markets of the country. In Chicago, in many ways the most important

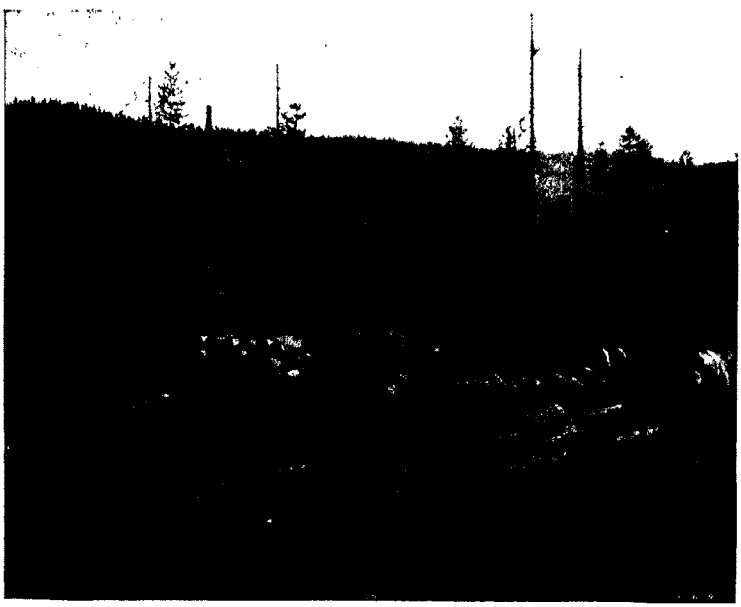


FIG. 26.—Loading cars with western soft pine logs in Kootenai National Forest, Montana.

lumber market in the country, white pine, Douglas fir, western hemlock, western soft pine, southern yellow pine, Arkansas soft pine, spruce, and hemlock all compete with each other. In the Metropolitan District in and around New York, all these species and, in addition, North Carolina pine are constantly competing with each other, while spruce from Canada competes with spruce from the Adirondacks and West Virginia. Adirondack birch, beech and maple compete with wood of the same species from Canada, Wisconsin, and West Virginia. Douglas fir and western hemlock compete with eastern hemlock, southern yellow pine,

spruce, etc. Specialized woods, such as cypress, compete with redwood and white pine for trim, finish, sash, doors, molding, etc.

At first the method of sale was direct; that is, the manufacturer sold almost entirely to the retail distributing yard. However, the removal of sawmills to great distances from the markets brought the wholesaler into existence. Instead of "lending enchantment," this increasing distance has often bred distrust and suspicion, on account of the dissociation of the buyer from the seller. Mills sometimes shipped off-grade lumber, hoping its inferiority would not be detected at the other end. Some buyers would make unjust claims against the lumber as received and even refuse to accept it from the railroad, claiming a reduction of several dollars per thousand feet on account of the presence of lower grades than those ordered, wrong measure, poor condition or appearance, or other complaints, real or imaginary.

To protect shipments to distant points, mills often preferred to sell through the wholesaler in whom they had confidence and who was located near the buyer. For the very same reason, the latter often preferred to purchase from mill representatives, or agents, or wholesalers located within easy reach by telephone or even by personal call.

Unethical and sharp practices frequently occurred during the early days of the industry but are now being rapidly eliminated by the following means:

(*a*) Establishment of reliable inspectors in principal markets to settle disputes and claims.
(*b*) Activities of manufacturers' associations to properly inspect stock as shipped.
(*c*) Efforts of credit agencies to promptly report concerns guilty of sharp practices.
(*d*) Work of the National-American Wholesale Lumber Association in arbitrating claims and protecting its members.
(*e*) Practice of inserting cards showing grade and count in each car shipped, also grade-marking each piece of lumber either with mark of manufacturer or wholesaler or of an association.

In the early days of the industry, manufacturers often shipped their lumber "mill run" and green from the saw. Many did not even take a piece tally, or grade or measure the lumber in any way. This in itself gave rise to innumerable abuses, some of which have been handed down to the present day.

THE FUNCTION AND POSITION OF PRINCIPAL AGENCIES OF DISTRIBUTION

Lumber passes through various channels in reaching the ultimate consumer. Although theoretically there is no economic function to be fulfilled by the middleman in the general scheme of distribution, the very exigencies of lumber distribution seem to demand his services. The fact that middlemen continue to exist and do a successful business in the face of intense competition is proof of their usefulness.

Lumber is a heavy, bulky commodity, and a long period generally elapses between the time of logging and manufacture and that of ultimate use after seasoning, handling and transportation. Thus, considerable financing is required in carrying the burdens in the interim. Sawmills have their own limitations of manufacture. The forests which produce the raw products for these mills vary from district to district. The consumer is generally far removed from the mill and consequently does not understand the problems and delays of manufacture and shipment. The manufacturers, on the other hand, do not always understand the particular demands of each local market, as these vary from region to region and from city to city. This gap must be bridged in some way. In some markets, for example, $2\frac{1}{4}$-inch face flooring only is marketable, while in others only $2\frac{1}{2}$-inch face flooring is in demand. Some cities permit 1-inch lumber dressed to $\frac{13}{16}$ inch, while building regulations in other cities admit the use of 1-inch lumber dressed to less than this minimum thickness and $\frac{3}{4}$-inch dressed lumber is marketed with difficulty.

Local customs and traditions are exceedingly important in the distribution of lumber. The barrier of custom is one of the most difficult problems with which the lumber business has to contend and contributes in a very material way to the wastage and misuse of the products of the forest. The public needs education regarding many technical aspects of lumber and its economic use.

The principal agencies in the scheme of distribution, aside from transportation and traffic, which are treated elsewhere, and the parts they play are as follows:

The Manufacturer and Manufacturers' Agencies.

At first there was no difficulty experienced in selling at the mill, since the markets were at no great distance, and the lumber buyers came to the sawmill. The centers of production and consumption were in close

proximity, the buyer and seller readily understood the problems and the peculiarities of each other's business, and few misunderstandings arose. With the increasing intricacy of the business of distribution, the enlargement of the producing units, and the removal of the source of supplies to great distances from the markets, new methods of bringing the producer and consumer together supplanted the former ones.

Now, about 65 per cent of our total lumber production is manufactured in a comparatively few large mills. Only a few of these are able to maintain large, adequate, and expensive selling organizations to move their products direct to the retail yard, the railroad, factory, contractor, and other consumers.

Manufacturers now have stated terms of payment and shipment, from which they do not often deviate. Large manufacturers, moreover, on account of the costs of their product, its unusually careful manufacture, and the high reputation established over a period of years, often secure from 50 cents to $5 more, per thousand board feet for their lumber than the smaller mills.

The lumber manufacturer is primarily interested in the F.O.B. prices at his mill and not so much in the price obtained in the different markets.

Selling organizations are generally found to be expensive, it may cost from 40 cents to $1, and in some cases as high as $1.50, per thousand board feet to maintain them. Sometimes manufacturers find it more expensive to maintain a sales organization than to merchandise their product through wholesalers, who, on account of their location, lower overhead, and knowledge of the producing and consuming problems, can handle the business in more economical fashion. Nevertheless, several of the large manufacturers maintain sales offices in the principal cities, and their sales representatives sell on a salary or commission basis or both. Others have only sales managers at the sawmill towns, who mail circulars, stock sheets, etc., to the trade and, by means of advertising through trade journals, popular magazines, or local media, keep their product before that section of the lumber-buying public to which they aim to appeal, whether it be the retailers, the wholesalers, or the consumers. The manufacturer often grants exclusive selling rights in a given territory to an agent or wholesaler who, however, may sell the same woods, as well as competing species, for other mills.

Some mills sell only to wholesalers at distant markets or to local buyers representing wholesalers. Other mills find an agreeable combination in both manufacturing and wholesaling—that is, selling the

product of their own as well as nearby mills from whom they buy through one central wholesale organization.

Some of the largest manufacturing organizations in yellow pine, Douglas fir, and white pine maintain line yards, particularly in the Middle West, and in this way sell directly to the consumer, eliminating the wholesaler and competing retailers. In one year, of 150 line yard companies operating in Minnesota and the Dakotas, 50 had headquarters in Minneapolis. Frequently, single companies own and operate from 30 to 50 line yards, and some individual companies own as many as 100.

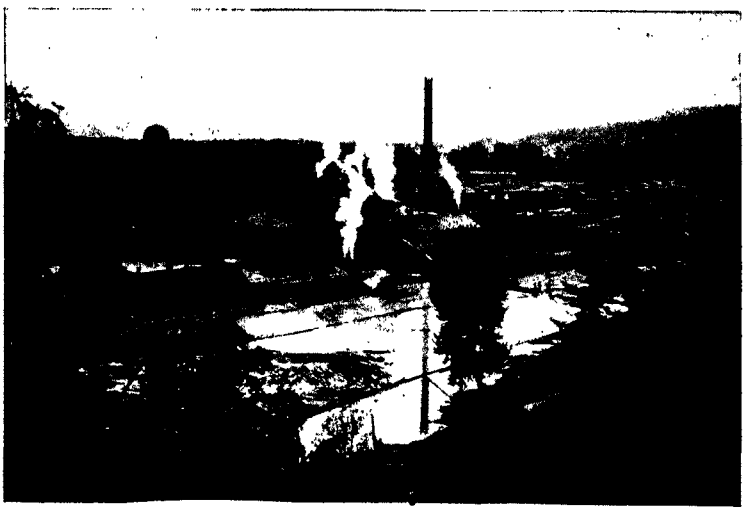


FIG. 27.—A large sawmill at Bonner's Ferry, Idaho. Log pond in foreground, mill in center, burner on the left and yards on the right.

Sawmills also often attempt to sell directly to large industrial enterprises, contractors having large construction operations, and other prominent buyers, such as railroads, oil companies, mines, etc.; in this way they sometimes compete with the retailer upon whom they depend to sell the bulk of their product.

Within recent years, several large groups of producing companies or manufacturers, each group operating under one general organization, have established selling agencies. Notable examples of these are the Southern Pine Sales Corporation of New York City, which handles the products of a number of mills in the Carolinas and Virginia, and the Weyerhaeuser Sales Corporation, with headquarters in St. Paul and

Spokane, which distributes the products of the various Weyerhaeuser organizations.

These concerns act as media or agencies for direct movement of lumber from the mills to the retail yards and other purchasers. In a sense they are acting as wholesalers and distributors of their own lumber and have been able to accomplish the desired results with marked success.

The Wholesaler.

As the result of conditions described previously, the wholesaler has come prominently into the industry. At the present time, according to a Forest Service report, not less than 60 to 80 per cent of all softwood lumber is distributed through the agency of the middleman, and a great majority, probably 80 per cent of hardwood lumber is handled in the same way. Hardwoods have been distributed in this way for a long time, but it is only within the past ten years or more that the wholesaler has entered so prominently into the distribution of softwoods.

The wholesaler depends largely for his success upon his intimate knowledge of the character and use of lumber, its distribution and the traffic problems connected therewith. Every carload of lumber sold by the wholesaler competes literally with similar lumber, sold by the manufacturer, as both manufacturer and wholesaler are competing constantly for the same business. The wholesaler must know intimately the methods and problems of lumber manufacture, the grading and inspection of the product, the customs and usages of the trade, traffic rules and regulations, freight rates, and the whims and prejudices of the buyer, together with his financial limitations, etc. With the rapid price fluctuations, he must anticipate the market trends in so far as possible, and must keep in constant touch with the producing and consuming centers.

Sometimes he limits his operations to one kind of wood; sometimes he handles hardwoods or northern hardwoods alone; or, on the other hand, he may handle a group of similar species such as white pine, California sugar pine, western soft pine, and Idaho white pine. Occasionally the wholesaler may handle all species of lumber and various other forest products, such as cross ties, piling, etc., in addition.

In general, there are two types of wholesalers, as follows:

1. Those who have large wholesale yards located at some point between the mills and markets, where they assemble, grade, dress, season, kiln-dry, or otherwise handle the lumber. Often they buy

mill-run lumber at a stated price and regrade and hold it for a rise in prices. They may be interested in companies that control the output of one or several small mills. They generally purchase lumber in the rough and resort or work the stock to suit the particular requirements of their customers among the retail yards, factories, etc.

Prominent examples of this type are located at Buffalo, Tonawanda, Memphis, Nashville, Cincinnati, Chicago, St. Louis, Cairo, Minneapolis and Norfolk. Albany was the first great center of this kind, fifty or one hundred years ago. Yards of this kind are proving very successful in Southern California and are now developing on the Atlantic Coast for the handling and distribution of West Coast woods.

This type of wholesaling involves expensive handling, including unloading, storage, and loading costs, two freight rates instead of one through freight rate, heavy taxes, overhead, insurance, etc.

Altogether it may be said that this class of wholesaler is gradually going out of business in the softwood industry, with the exception of the southern California, Buffalo, Atlantic Coast, Tonawanda, and a few other distributing yards. The principal reason for the disappearance of the large distributing yards of several years ago is that the forests which supplied them have been almost entirely cut down.

2. The other type of wholesaler carries no stock, has no yard, and seldom sees the product which he buys or sells. He may have one or more buying offices in the producing region of the lumber in which he is interested. He knows the conditions at these sawmills intimately—the size and character of their stocks, and the requirements of his customers with reference to them, and often assists financially both the mill operator and the buyer by extending favorable terms. This feature is exceedingly important, as large manufacturers seldom deviate from their terms, and a favorable terms clause will often be the deciding issue with the buyer, rather than the price of the stock delivered at his plant or yard. Moreover, the wholesaler may assist the manufacturer financially over a difficult period and consequently be able to purchase his lumber at a price which permits him to compete with other manufacturers.

This type of wholesaler, generally speaking, invests comparatively little capital in the business, but he gives service in the way of inspection, in informing the buyer of car number, time of shipment, and data about grades and conditions which the manufacturer at some distant point is less readily able or willing to give him.

Some wholesalers restrict their business to retailers, while others solicit railroads, contractors, industrial plants, ship-building concerns,

building operators, furniture factories, etc. Retailers generally have refused to purchase from wholesalers who try to sell directly to their customers. This, of course, applies to manufacturers as well. Retailers generally concede the propriety of the wholesaler's selling directly to the railroads and ship-building concerns.

Wholesalers may buy up stocks in advance of sales and hold them for a rise in prices, or they may sell in advance of their purchases. The latter is a very common practice. They keep in constant touch with the mill stocks and offerings and know at what prices roofers, timbers, dimension, etc., can be purchased. As soon as their sales contract is consummated they proceed to cover their orders to best advantage. They may have from 50 to 100 mills with which they keep in close touch, and generally know the mills that have surplus stocks of given sizes and grades and are anxious to sell them. By means of cash payments they can frequently buy surplus stocks at a large concession in price. Wholesalers' offices are in receipt of constant offerings from manufacturers and wholesalers located near the mills, both in the form of stock sheets and of specifications of transit cars which they have been compelled to move on account of lack of storage facilities, money stringencies, or both.

Wholesalers must be expert in traffic matters, particularly freight rates, routing etc. As mills are chiefly interested in F.O.B. prices and buyers in delivered prices, the wholesaler must reconcile the two to his own advantage.

Some wholesalers are interested in both mills and retail distributing yards and therefore occupy a favorable relation to both branches of the business.

The wholesalers' profit on high-grade stocks is large, but the volume of such business is relatively small. On dimension stocks, roofers, and timbers he may secure a profit from 50 cents to $1.50 per thousand board feet, depending upon the volume of the order, intensity of competition, terms, etc. On the better grades of softwoods and firsts and seconds in hardwoods he may secure a profit of $1 to $5 per thousand or even more.

The wholesaler's ideal in conducting his business is to make purchases before a rising market and to sell at the beginning of a falling market or at the peak of price activity.

Former unethical and sharp practices, of which both the wholesaler and the manufacturer have been guilty, are being rapidly done away with. The mixing of grades, shipping of green lumber when dry lumber is ordered, short count, shipping grades lower than specified, shipping

maximum carloads when prices are high and profits are attractive and minimum carloads when the reverse is true, are being eliminated largely through the activities of the prominent wholesalers' and manufacturers' associations, the work of credit agencies, the adoption of higher ethical standards within the industry at large, etc., as has been heretofore described.

The Commission Man.

The commission man sells purely on a commission basis and has no responsibility in the matter of shipment, delivery, or carrying of accounts He may sell for either manufacturer or wholesaler. His commission varies from about 50 cents per thousand board feet on cheap and highly competitive lumber, such as roofers, small dimension, timbers and common grades, up to $1 or $2 per thousand board feet on high-grade hardwoods, flooring, finish, and the better grades of softwoods.

In many instances the commission man occupies a very important place in the distribution of lumber. On account of his failure to accept responsibility, however, his position has given rise to many disputes in the lumber trade. His commission is usually paid upon the delivery of the order and the closing of the account, although some firms pay half on the acceptance of the order and the balance on its final delivery and payment.

The Retailer.

The retail lumber dealer is the ultimate distributor of lumber; it is estimated that 70 per cent of all our lumber products is distributed through the channels of the retail yards. They sell in both large and small lots and constitute the backbone of the marketing and distributing system.

The retail lumber dealer is usually a very responsible, reliable, and active member of the community. Consequently he is entitled to good terms of payment and high rating in the credit agencies.

The retail lumber business is, generally speaking, heavily overcrowded. From the very nature of the business, the retailer must incur heavy costs for taxes, unloading, piling, handling and distributing of lumber. His storage and overhead charges are exceedingly high, and consequently the cost of doing business varies from 15 to 25 per cent of the purchase price. The cost of doing business in country yards is generally higher than it is in city yards.

The success of retail lumber dealers generally depends upon:

1. Location.
2. Energy, activity and efficiency in operation.
3. Buying under advantageous conditions of terms and prices.
4. Properly directed advertising and merchandising.

Practically all the buyers of lumber purchase through the retail yards, except the larger industries which can afford to purchase in carload lots and have the necessary storage space.

Some retail houses maintain wholesale departments and in this way cut down the expenses for their own lumber and also handle lumber in carload lots to customers who habitually purchase wholesale quantities.

SALESMANSHIP

In the early days of the lumber industry, lumber literally sold itself. There was a large demand, chiefly local in character, and buyers came directly to the mills. Hence there was little need for development of the art of salesmanship.

Even during recent years, the methods used in selling lumber in this country, generally speaking, have been somewhat ineffective and have not kept pace with the methods adopted and successfully used in other prominent American industries. One principal defect in the scheme of selling lumber has been that the men so employed have not been especially trained for the work and they have had insufficient knowledge of lumber as a structural material and a useful commodity.

Competition Demanding Better Men and Methods.

During the past ten to twenty years, the lumber business has been characterized by intense and growing competition. This competition has forced the attention of lumber companies to the merchandising of their product on a more scientific basis. Higher-grade men are being used as salesmen and men are being especially trained for the work. A few years ago a convention of Southern pine lumber salesmen was held in St. Louis, for the purpose of demonstrating the need for better men and methods.

Salesmen are now being trained to understand the particular merits and advantages of the wood which they are attempting to merchandise, as well as the limitations of the raw products, the grades and finished sizes and uses of each species. Not only are salesmen expected to know the policies and limitations of the company which they represent, but

they are expected to know a great deal about the species of wood in competition with which they are attempting to sell their own products.

Furthermore, wood must now be sold on its merits in competition with other materials. The active efforts of manufacturers of substitute materials have forced lumbermen to realize that the merchandising of their products must be placed on a much more substantial basis. Refined methods of merchandising are also being adopted, such as the extended use of stock sheets and lists, the proper preparation and use



FIG. 28.—Steam skidding and loading logs on a spur track in western Washington. (Photograph by U. S. Forest Service.)

of selling letters, the extended use of telephone and telegraph, and improved methods in the business as a whole.

Competition among the retail yards has also developed better salesmen in this branch of the industry, in which even greater advances have been made than in some of the other branches. Instead of waiting for business to come to the yards, the retailers are now going after the business and employing salesmen to sell not only to architects, contractors, carpenters, and builders, but to the owners of homes. To-day it is a common sight to see advertising signs of retail yards posted on all forms of new construction, as well as signs hung in trolley cars, on the sides of

delivery trucks, on billboards, in trade journals, local newspapers, magazines, etc.

Psychology of Selling.

With the more intense development of selling methods by manufacturers, wholesalers, and retailers, more and more attention is being given to the psychology of selling. This is not a phase of selling peculiar to the lumber business, but is a generally recognized theory of modern merchandising methods. In many organizations salesmen are given a thorough preliminary course in the various applications of psychology, in approaching the customer, in doing so-called missionary work, and finally in effecting sales.

Some of the important features which are emphasized by the more modern and progressive companies in the three great branches of the industry, as noted above, are:

1. How to " size up " the customer and judge his strong and weak points.
2. How to recognize the most likely prospects and how best to reach the right man.
3. How to appeal to persons of different ages.
4. The appeal to the five senses.
5. How best to use selling features and special advantages of the particular stock which the salesman is most anxious to sell.
6. How to make the sales canvass and plan more successful sales.
7. How to improve one's personal efficiency, including mannerisms, habits, speech, personal appearance, etc.
8. A study of motives which make people buy.
9. How to win the customer by instructive appeal.

Each of the above subjects is frequently studied in detail either individually or in classes. The experienced salesman thoroughly appreciates the necessity of cultivating proficiency in each of the above suggestive points.

Training of Salesmen.

Until recently, almost anyone familiar in a general way with the problems of manufacturing, grading, and uses of lumber has been considered eligible for the work of selling lumber either in wholesale or retail quantities.

The larger organizations, however, have felt the necessity of some

systematized training for their sales representatives. The manufacturers of southern yellow pine considered this subject of sufficient importance to call a general salesmen's convention a few years ago in St. Louis. Modern business at large recognizes the desirability of efficient training of its salesmen, and in many lines of industry special courses of one month to a year's duration are required before the salesman is permitted to merchandise the products of those industries. In recent years, world salesmanship congresses have been held, wherein methods and advantages of selling various types of merchandise have been explained by those who have become most expert and efficient in their particular lines of endeavor.

It is generally recognized within the lumber industry, that, whereas lumber formerly sold itself, it must now be sold under highly competitive conditions, not only as against other kinds of lumber but in competition with other materials. Consequently, salesmen are being trained in more exact knowledge of the technical properties and uses of the woods which they sell, whereas until recently the chief facts which they were expected to know were the grades and sizes, and the prices at which each size and grade could be sold at the various delivery points. Now a salesman must know something about stresses and strains and other strength properties. The comparative hardness and durability of the different woods, the relative ability to take and retain different forms of paints and stains, relative workability, softness, pitchiness of the woods which are being merchandised, as compared to those with which they compete, the preservative and lasting qualities of the different woods used for shingles, bridge timbers, paving blocks, cross ties, etc., are all important technical properties, but are only a few of the many facts which the salesman should have at his ready command in attempting to make sales for the various purposes for which his lumber is suitable or may be best used.

At many of the sawmills, young men are given a regular training in grading, inspecting, seasoning, both in the pile and in dry kilns, shipping and handling of the lumber product, in order to equip them for efficient merchandising methods when representing the same concern in the important lumber consuming markets. In some cases companies send representatives to the United States Forest Products Laboratory at Madison to secure more scientific information regarding kiln-drying methods, the manufacture and testing of various forms of boxing and crating, the strength and technical properties of woods and other phases of the subject, to train them to become more efficient salesmen.

It is also becoming more generally recognized that lumber salesmen should have a background of training in technical schools of forestry and engineering, combined with practical experience in lumber manufacture, grading, and handling lumber at the sawmill. In the retail yards and factories, salesmen are sometimes given a preliminary training in the study of the local lumber market and the particular demands of the various industries which may use the product of these yards or factories.

OFFICE PRACTICE

Methods employed in the merchandising of lumber are being made more and more uniform, particularly in the manufacturing and retail divisions of the business; with the wholesaler, current business methods and practices vary very considerably. In the case of the middleman, the very nature of his business requires him to vary his methods of merchandising according to the character of the mill from which he buys and the retailers or concerns to which he sells.

In general, the following is a brief summary of methods of procedure in merchandising American lumber.

Orders.

Orders are always taken subject to the acceptance of the head office, and written confirmation and acceptance of orders are always sent out with terms, specifications, etc., carefully checked. Copies of acceptance of orders are always mailed to the salesman, branch offices, and mills, in the case of the manufacturer. In the case of the wholesaler, all those involved in the transaction receive copies of either the original order with some acceptance form marked on it, or a formal acceptance.

Orders are frequently incomplete or improperly made out and consequently are the source of claims, litigation, and difficulties that should be unnecessary.

It is not always fully appreciated that an order is a contract and should therefore be a complete "meeting of the minds." Generally speaking, orders should include the following:

(*a*) Species, grade, and condition of stock, whether green, air-dried, kiln-dried, "skin" dry, or shipping dry, etc.

(*b*) Items of each species and grade with number of pieces or board feet, size, length, etc., for each species.

(*c*) Rough or dressed, with exact method of dressing, finished sizes, etc.

(*d*) Destination with delivery railroad, siding, lighterage point, etc., plainly shown.

(*e*) Terms of payment.

(*f*) Time of shipment.

(*g*) Grading rules, inspection certificates, or other rules covering the shipment, also methods of arbitration in case of disputes.

(*h*) Other conditions, such as size of carload, method of loading, on gondolas, freight, or box cars, etc.

Orders are always taken subject to acts beyond the control of shippers, including fire, floods, accidents, labor disturbances, embargoes, changes in railroad regulations, acts of the Government, wars, etc., sometimes referred to as "*force majeure.*"

The general practice with manufacturers is to make their sales F.O.B. cars at shipping point, with freight allowed to destination, with the practical and legal result that the buyer becomes the owner as soon as the goods are loaded and the bill of lading issued, although the manufacturer guarantees the delivered price. This relieves the manufacturer of liability for delivery, and in the event of damage, destruction or loss of goods en route, the buyer must look to the carrier for redress.

The normal routine in handling orders in a manufacturing or wholesale office is approximately as follows:

When orders are received from salesmen, they go first to the credit department which records the credit limit that may be extended to each customer, examines the terms of payment and the amount of outstanding notes or other indebtedness. If the order is acceptable from a credit standpoint, it next goes to the sales manager who examines it for price, time of shipment and other practical considerations. If he accepts the order it is then given an order number by the order clerk who acknowledges it to the customer and salesman. Each order is identified by both the number and the name of the customer and copies of all correspondence, telegrams, telephone messages, acknowledgment, freight ladings, invoices, specifications, etc., are filed together. The sales manager next places the order in the hands of the mill which is to ship the stock. Wholesale houses which maintain buying offices forward their orders to the lumber buyer, who then arranges to fill the order from stocks held or places it with some mill after ascertaining the avail-

able quantities, the terms, prices, and other conditions from several mills which are in a position to quote on a favorable freight rate basis.

In the case of the retailer, it is largely a question of having the desired lumber in stock, as shown by his inventory. If sufficient time is available in which to deliver the lumber called for in the order, and his yard does not contain it, the retailer may order directly from the mill. An order often requires from one to three months between the time it is placed and the time the stock is finally delivered at destination. In this way the retailer may deliver directly from car to place where buyer wants the lumber and so save double handling and storage charges.

The accompanying order form, endorsed by many of the leading retailers', wholesalers' and manufacturers' associations, including the National Retail, National Manufacturers', The National-American Wholesale, the Yellow Pine Wholesalers', West Coast Lumbermen's, Ohio Retailers' and New Jersey Retailers' Associations, is generally conceded to be the most complete, explicit and inclusive order form yet devised and is satisfactory alike to all three branches of the industry.

Shipments.

Immediate shipment generally means from one to two weeks, and prompt shipment from four to eight weeks, from the date of receiving an order. Orders are usually telegraphed from wholesalers or sales representatives directly to the mills. Usually the time of shipment is specified on an order and is determined by the date on the bill of lading.

Many mills endeavor to take orders to be shipped as soon as ready or at the convenience of the mill. This, however, is usually undesirable from the buyer's point of view.

As soon as a carload is shipped, the car number is sent to the wholesaler or buyer, and the car is traced if long delay ensues. The wholesaler appears as the shipper as well as the consignee. In any event, the bill of lading usually states who should be notified in addition to the consignee. Shipments are generally sent freight collect at destination.

Although buyers usually desire the wholesaler to specify time of delivery, this is seldom if ever guaranteed, on account of the uncertainty of movement on the common carrier. The seller, moreover, does not insure against breakage, loss or damage to material while in transit. This is an obligation which rests upon the railroads. Water shipments, either coastwise, by inland waterways, or to foreign ports, are always insured by the shipper.

PROPOSED UNIVERSAL ORDER BLANK

ORDER

JOHN DOE LUMBER COMPANY

No......*Street (or Bldg.)*

Cincinnati, Ohio

Buyer's Order No.....
Seller's Order No.....
Salesman's Order No.....
Date. ....., 192...

To. Address .....
Ship to.....At.....
For.....R. R. Delivery .....
Send Invoice to.....At.....

SHIP THE FOLLOWING

*QUANTITY	DESCRIPTION AND SPECIFICATIONS	Price F. O. B. cars At .....
	(Substitutes Not Accepted)	

TERMS: Freight net cash. The amount of invoice less freight paid, is subject to the following settlements: (*a*) Cash less 2% if paid within five days after arrival of car as shown by date on expense bill. (*b*) Net if closed within five days from arrival of car, by note or trade acceptance, due ninety days from date of invoice and bill of lading. (*c*) Invoice not discounted or closed by acceptance is net and due in 60 days from date of invoice and subject to sight draft 65 days after date of invoice.

* Specify definitely number of pieces. Unless otherwise specified, a carload of lumber products shall be of fair average weight but not less than minimum nor more than maximum car.

It is Agreed:

CANCELLATION (1) That failure to ship this order within..... .....days from date shall give the buyer the option to cancel, but this agreement shall not be construed to constitute cancellation without request in writing, received by seller from buyer, five days prior to shipment, and order is not subject to cancellation before expiration of the due date, as shown above, nor of special stock in process of manufacture, without the consent of the seller.

UNLOADING (2) That contents of car shall be unloaded upon delivery.

COMPLAINTS (3) That seller shall be notified promptly in case of complaint on grade or tally, and contents held for a reasonable time at seller's expense and disposition

INSPECTION (4) That official inspection according to established grading rules specified of the species described herein shall govern unless otherwise agreed or adjusted.

DISPOSITION (5) That hardwood shall be held intact unless otherwise agreed.

OF MATERIAL (6) That buyer may use any part of a shipment (except, see No. 5 herein), and in such case shall pay at invoice price for all that part used.

(7) That remainder of shipment shall be held intact for official inspection, or adjustment. All lumber determined to be up to grade shall be paid for according to invoice price, stock below grade to remain property of seller, unless otherwise agreed.

COST OF INSPECTION (8) That in case any official inspection shows material to be not more than 5% off-grade, or if tally is not short more than 1% of invoice quantity, it shall be deemed an acceptable shipment on contract, and all costs of such inspection shall be paid by the buyer; otherwise, costs shall be paid by the seller

ARBITRATION (9) Disputes arising, which are not covered by official inspection, may be submitted for arbitration.

FREIGHT AND WAR TAX Government tax and any advance in freight rates to be paid by Buyer; any reduction to be credited to Buyer.

UNAVOIDABLE DELAYS This order is contingent upon strikes, Act of God, and causes beyond Buyer's or Seller's control.

INSERT HERE ANY CHANGES, OR ADDITIONS, IN THIS ORDER BEFORE SIGNING:

This Order is taken subject to acceptance or rejection by Seller's home office at.....within .....days from date of receipt hereof, to be forthwith confirmed to Buyer.

ACCEPTED, subject to the terms and conditions named herein

For.....

By.....

Salesman's Signature.....

THE JOHN DOE LUMBER COMPANY

BY.....

Original copy to Seller, returned to Buyer, with signed confirmation; duplicate copy to Seller; triplicate copy to Buyer.

Invoices.

Invoices are mailed to the buyer as soon as the car is accepted by the railroad for shipment. Invoices should always state the terms and the freight rate and measure as shipped. A piece tally usually accompanies the invoice, giving the number of pieces, size, and length of each kind of lumber shipped.

The freight agent at destination notifies the consignee of the arrival of the car and the latter pays the freight and deducts this from the invoice, forwarding receipted freight bill to manufacturer or wholesaler as evidence of actual freight paid. Sometimes a certified copy of receipted freight bill is adduced in lieu of original.

Terms of Payment.

Manufacturers generally have stated terms, and orders are accepted by the credit department only from concerns whose rating is sufficiently high.

Manufacturers' terms are usually as follows:

(*a*) All prices are based upon F.O.B. cars at destination, freight net cash to be paid by purchaser on arrival.

(*b*) Payment made net cash thirty to sixty days from date of shipment, or 2 per cent discount on net amount of invoice after deducting freight if paid within ten to twenty days from date of invoice.

Freight allowances are only made on surrender of original or certified copy of receipted freight bill. Remittances must always be made free of charges and exchange is usually charged to buyer's account if any is required. If accounts are not paid at maturity they are subject to sight draft together with cost of collection.

The wholesaler's terms vary with his financial condition, the character, financial standing, and needs of the buyer, and the terms under which he can purchase from mills. To facilitate financing, he naturally prefers to secure his remittances before or as soon as he pays the mill. The wholesaler is frequently willing and able to extend better terms to the retail yards and other buyers than the manufacturer, and often takes trade acceptances or notes from buyer in lieu of cash. Buyers in good financial condition usually take advantage of the trade discount.

For export shipments it is customary for the manufacturer to receive cash against documents upon delivery at port of loading. Where an

exporter. is well acquainted with mills, more satisfactory terms are extended, but sight draft attached to bill of lading is a common method of making payment.

CREDITS AND COLLECTIONS

Credit Information.

The two sources of credit information most commonly used by the three great branches of the industry are the Blue Book issued by the National Lumber Manufacturers' Credit Corporation of Chicago and designed particularly to meet the needs of the manufacturer by giving the credit ratings and standing of practically all buyers of lumber throughout the country, including retail yards, factories, contractors, individual plants, etc., and the Red Book, issued by the Lumberman's Credit Corporation of Chicago and used by both wholesalers and retailers as well as other buyers of lumber and to a large extent by manufacturers as well. Both the Red Book and the Blue Book keep constantly in touch with the local reputation, financial standing, and responsibility of all concerns listed, and furnish information of great value to their subscribers.

All branches of the lumber industry, including the manufacturer, wholesaler, and retailer, also use the two well-known sources of credit information regarding the standing, both financial and moral, as well as the legal responsibilities of both buyer and seller, namely Dun's and Bradstreet's.

In addition to the above sources of credit information, the local banks, customers, and associations, including the manufacturers', wholesalers', and retailers' associations, are constantly used as important and reliable sources of credit information.

Determination of Ratings.

Opinions vary considerably regarding the rating of individuals, corporations, and unincorporated companies. A concern may be a small one, but if its past history, local reputation for doing an honorable business, and method of meeting its obligations have been above reproach, it is entitled to highest consideration in a proper determination of its credit standing.

Altogether, however, the following factors determine to a very large degree the ratings of organizations with which the various branches of industry do business.

1. *Capital.*

The amount of stock paid in by an organized company or the amount of capital invested by an individual in his own organization is looked upon as one of the best direct evidences of the standing of a concern. However, this factor alone is seldom considered final in any sense.

2. *Reputation and general character.*

Practically every business concern in all branches of industry guards very jealously its reputation, both local, regional, and national. The esteem and repute which a firm enjoys in its own locality is usually considered of paramount importance; and for this reason banks, local customers, and competitors are often consulted regarding the reputation and character of any given concern.

3. *Method of, and promptness in, meeting obligations.*

After terms are once agreed upon, it is generally considered of prime importance that the parties fulfill their obligations in accordance with their contract promises. The repeated renewal of notes, trade acceptances, etc., is looked upon unfavorably by the credit agencies. Many companies pay their bills on a cash basis, taking advantage of all available discounts, and sellers of lumber are very often willing to accept a lower price if invoices are met on this basis.

Collections.

Lumber manufacturers, through their credit departments, guard their accounts very jealously and are particularly careful not to do business with customers who may be embarrassed in fulfilling their obligations. Consequently, manufacturers, particularly among the large companies, have, generally speaking, had little trouble with collections, although in periods of depression collections are always much slower than in active or boom periods when money is easier and borrowing rates much lower.

Some of the associations maintain bureaus or departments which look after collections for their members and have done very effective work, not only in collecting past due accounts, but in maintaining up-to-date and accurate credit information.

Retailers are generally considered the most responsible buyers of lumber. They are generally prominent members of the local community and have considerable investment in property and in their business; they therefore guard their reputations very carefully. Retailers generally pay their bills promptly, and the loss by shippers, whether they are wholesalers or manufacturers, is exceedingly low and practically

negligible in all sales to retail yards. A prominent manufacturer estimates that probably 75 per cent of all settlements made by retailers are on a cash basis, and advantage is usually taken of all trade discounts. Collections from contractors are very often on a cash basis as well.

Retailers themselves, however, have more difficulty in securing collections from their customers. It is estimated that losses of one-half of 1 per cent to 1 per cent among the retail yards are only too common, whereas the losses to wholesalers and manufacturers are very much less.



FIG. 29.—A familiar sight in the lumber industry of the Pacific Northwest—towing a raft of logs, usually 24 to 40 feet in length, to a sawmill.

The retailer, as is true of retailers in all lines of business, gives from thirty to sixty days' time, and the same difficulties are encountered in making collections as are no doubt commonly met in all retail lines of business.

The credit department is often made one of the divisions of the general sales department. The credit man should have the point of view, the instincts, and ability of a salesman. There should be the closest cooperation between the salesmen and the credit man, as their duties are often reciprocal in that the credit man can aid the salesman in effecting sales whereas the salesman is in an excellent position to assist

the credit department in keeping its records up-to-date and protecting the best interests of the company.

The credit manager determines not only the acceptance of each order but also the amount of credit to be extended to each customer. His position is one which requires tact and diplomacy, as he must avoid unpleasant controversies with customers and keep them in a receptive frame of mind toward the salesman.

In many of the large retail and wholesale as well as manufacturing companies, every order before being accepted is sent to the credit department to have stamped on its back not only the indication of acceptance but also the amount of credit to be extended to the particular customer, the amount owing, and the number of unfilled orders.

FINANCING SALES

Because of the length of time required for delivering lumber at destination, large amounts of capital are tied up in unliquidated funds. It is generally considered good practice in the industry to keep all available working capital as liquid as possible at all times.

When the manufacturer sells to the wholesaler it is usually on the basis of sight draft for 80 per cent. The manufacturer discounts this draft at his bank and in this way obtains immediate funds. When the manufacturer and wholesaler sell to the retail trade they sell on the usual terms, that is, 2 per cent discount for payment within ten to twenty days from date of invoice, net cash thirty to sixty days from date of invoice. Frequently the seller assigns accounts to banks or financial institutions which specialize in this kind of business and in this way the seller receives an advance of 80 per cent of the estimated net amount. Notice of assignment in this case is always stamped on the invoice itself. Banks and financial concerns frequently require the seller to insure his accounts, which involves some expense. If the account is not paid when due at maturity, the bank charges the seller's account with the amount advanced. A good many buyers settle by trade acceptances, which have come into common practice to a considerable extent within recent years. The seller then discounts these trade acceptances and obtains funds with which to carry on his business.

Retail lumbermen generally sell on the usual retail terms, and the added expense of carrying their customers for at least a short period of time is included in their selling price.

PRICES

Theory of Prices.

Fundamentally, the old economic law of supply and demand and the cost of production are the underlying forces which determine the price of lumber. However, recurring periods of activity and depression are constantly succeeding each other, as in many other essential and important industries. Lumber prices rise and fall rapidly, even abruptly at times, and probably more so than is the case in other basic commodities because there are so many competitive influences at work and so many different species produced in many scattered manufacturing centers.

Economic forces are constantly at work to stabilize prices. For example, when prices are high and therefore attractive to the manufacturers, mills speed-up production, night shifts are often operated, and idle mills begin sawing to take advantage of the rising or high prices. This results sooner or later in meeting the demand, as a " flood " of lumber is eventually dumped upon the markets; and if this is long continued, as is often the case, there is an over-production with a consequent fall in price and too frequently in an abrupt collapse in price levels, followed by a period of stagnation, low prices, with selling made difficult through intense competition and the usual resultant depression. This period of inactivity continues until the mills, after elimination of night shifts, may cease operating altogether because the price levels may be below the actual cost of production. To make a bad situation worse, some mills are forced to operate even at a loss to meet current interest charges on bonded or other indebtedness.

When available stocks are absorbed, both at the sawmills and in the retail and wholesale distributing yards, and construction activity is renewed, with orders coming in more rapidly, these conditions are gradually reflected in rising prices, and the cycle is eventually completed and a new cycle begun. These cycles or price " booms " and depressions may be repeated rapidly or may occur over an extended period of time. There are also major and minor movements in the curves of advancing or falling prices. For example, after the World War the sudden cessation of hostilities left the country with low stocks at the mills. These mills had been operated largely for war purposes and essential industries, house-building and general construction having been temporarily abandoned. Lumber manufacturers were in a quandary as to what prices they should set for their stocks. Following the period of inactivity, construction started rapidly in the spring of 1919, and until the follow-

ing spring there was an unprecedented demand for lumber. Prices consequently advanced until all available mills began operating to capacity and transportation facilities were taxed to the limit. When the supply caught up with the demand, about May, 1920, there was an equally sharp break in the market and prices fell as rapidly as they had risen to this high peak. Until the fall of 1922, there was a general depression of sales of all kinds throughout the country. Within this three-year period, however, there were rises as well as breaks in the curve of falling prices, although the major movement was in the downward direction. In the fall of 1922 and the following winter there was an upturn in prices.

With the rapid cutting of all virgin forests, there is sure to be a gradual rise in the curve of prices. This is evident in the gradual advance from 1900 or even earlier to the War period as shown in the accompanying diagram.

The percentage of waste both in the woods and at the mill increases in almost direct proportion to the cheapness of lumber. Conversely stated, high prices mean conservation of the raw material. For example, during periods of high prices the difference between the clear and common grades of lumber is much less than in periods of low prices. During the latter periods No. 3 common and No. 4 common in both softwoods and hardwoods are marketed with difficulty even at prices far below the cost of production, whereas in periods of high prices the lowest grades are marketed and it pays lumber companies to take logs closer in the tops and to cut low stumps and use semi-defective logs which, during periods of reverse conditions, would be left to rot in the woods.

Conditions which Affect Prices.

Aside from the general economic laws of supply and demand which basically affect the prices of lumber, there are a number of conditions which directly affect the prices at which lumber may be sold. The principal ones are as follows:

1. The relation of the price of a given species, which has risen in value, to the price of other woods which may compete with it or may be used as substitutes for it. For example, with the growing scarcity of white pine, the most valuable and formerly the most widely used American construction lumber, other species which could be sold at lower price levels are sold in competition with it, particularly southern yellow pine, hemlock, western pine, and Idaho white pine.

2. Traffic congestion, such as embargoes, car shortage, etc. These factors frequently cause a sharp advance for lumber in certain markets.

3. Transit cars. In many markets the use of transit cars usually has a depressing effect upon prices. If it is generally known that a large number of transit cars are en route to a certain section of the country this will automatically lower the price for similar stock sold in the usual way.

4. Need of manufacturers for funds. Mills will often sacrifice their prices in order to secure ready cash to meet their payroll or their interest on notes or bonded indebtedness.

5. Local construction activities. There may be considerable building activity in southern California or in certain sections of the Prairie States, whereas building may be stagnant in New England or in other sections ordinarily considered active lumber markets.

6. Competitive influences as between species which may be used equally well for similar purposes. In such cases freight rates are often the deciding factor. In fact, freight rates frequently determine the limits of competition in which given species of lumber may indulge.

7. Stumpage prices, together with the cost of logging and manufacture.

Competition is the great and often the deciding factor in governing the prices at which certain grades and sizes of lumber may be sold. Some mills are willing to take smaller profits than others. Some will sell at a loss during depressions in order to retain the good-will of their customers. Stocks accumulated or purchased by wholesalers during depressions are sometimes sold under the " market " in order to move them more rapidly. There are many and constant cross currents of competition affecting the prices of lumber both at the sawmills and at the consuming markets.

Undercapitalization and Overcapitalization.

Undercapitalization has been directly responsbile for considerable demoralization and even serious losses in the economic structure of the industry. Many companies starting on a small financial basis have become heavily loaded with bonded indebtedness, heavy interest, and other overhead charges, as a result of extended acquisitions of stumpage and expense in manufacturing operations and have been forced to " break " the market in order to move stocks rapidly and receive cash settlements. This has resulted in situations seriously embarrassing

both to themselves and to others. On the other hand, if financially sound, these companies could have maintained sales at regular market prices and the entire industry could have been maintained in a more satisfactory economic condition.

AVERAGE VALUE F.O.B. MILL PER THOUSAND FEET BOARD MEASURE, BY KINDS OF WOOD, FOR SPECIFIED YEARS, 1909-1920.—Taken from U. S. Forest Service Figures.)

Kind of Wood.	1920	1919	1918	1917	1916	1915	1911	1910	1909
All kinds	$38.42	$30.21	$24.79	$20.32	$15.32	$14.04	$15 05	$15.30	$15.38
SOFTWOODS									
Yellow pine	35.89	28.71	24.38	19.00	14.33	12.41	13.87	13.29	12.69
Douglas fir	34.59	24.62	18.77	16.28	10.78	10.59	11.05	13.09	12 44
Western yellow pine	38.73	27.75	20.87	19.59	14.52	14.32	13.62	14.25	15.39
Hemlock	32.05	29.16	23.97	20.78	15.35	13.14	13.59	13.85	13.95
White pine	41.49	32.83	30.84	24.81	19.16	17.44	18.54	18.93	18.16
Spruce	38.94	30.76	28.65	24.41	17.58	16.58	16.14	16.62	16.91
Cypress	51.02	38.38	30.56	23.92	20.85	19.85	20.54	20.51	20.46
Redwood	46.90	30.04	24.30	21.00	13.93	13.54	13.99	15.52	14.80
Larch (tamarack)	30.28	23.39	19.86	16.21	12.49	10.78	11.87	12.33	12.68
White fir	30.44	25.66	19.61	17.16	12.25	10.94	10.64	11.52	13.10
Cedar	38.68	33.80	24.86	19.40	15.24	16.10	13.86	15.53	19.95
Sugar pine	48.76	35.99	28.26	24.69	16.77	17.40	17.52	18.68	18.14
Balsam fir	34.33	32.23	27.27	20.02	16.49	13.79	13.42	14.48	13.99
Lodgepole pine	30.58	29.98	20.95	18.34	15.13	13.57	12.41	14.88	16.25
HARDWOODS									
Oak	46.88	37.87	31.11	24.49	20.06	18.73	19.14	18.76	20.50
Maple	50.16	35.56	29.05	23.16	18.24	15.21	15.49	18.16	15.77
Gum, red and sap	35.24	32.68	23.21	19.56	14.64	12.54	12.11	12.26	13.20
Chestnut	42.48	32.30	27.31	21.54	17.05	16.17	16.63	16.23	16.12
Birch	53.44	35.79	29.94	24.07	19.59	16.52	16.61	17.37	16.95
Yellow poplar	58.87	41.56	35.06	27.17	21.89	22.45	25.46	24.71	25.39
Beech	36.51	29.97	25.06	19.58	16.20	14.01	14.09	14.34	13.25
Elm	47.23	36.39	28.19	22.89	19.46	16.98	17.13	18.67	17.52
Basswood	54.28	40.03	34.00	25.96	21.05	18.89	19.20	20.94	19.50
Tupelo	33.68	28.42	22.73	18.06	13.00	12.25	12.46	12.14	11.87
Ash	61.28	52.69	38.70	30.01	23.85	22.15	21.21	22.47	24.44
Cottonwood	33.38	32.24	26.13	23.19	17.42	17.36	18.12	17.78	18.05
Hickory	52.57	44.37	37.95	29.48	23.84	23.35	22.47	26.55	30.80
Walnut	88.92	72.13	77.60	72.99	42.38	48.37	31.70	34.91	43.79
Sycamore	32.12	30.42	23.59	18.68	14.65	13.86	13.16	14.10	14.87

Depressions have meant particularly heavy losses in the salability of some of the lower grades which, during periods of business reverses and lack of construction activities, can scarcely be moved at any figure. Low prices mean heavy waste, whereas the reverse means conservation of our wood supplies and more complete utilization. It is a peculiar fact that during periods of construction activity the price differentiation between the high and low grades is much less than during dull and inactive periods.

In common with some other American industries, the lumber industry is equipped to manufacture more than twice the possible annual consumption of lumber in both domestic and export markets. Many mills are only operated on part time, and others are operated only in anticipation, or on evidence, of strengthening markets. When the market demands become heavy many mills increase their production and small mills come into existence, causing overproduction and a consequent collapse in price with the usual depression in the industry.

A recent Secretary of Labor remarked that the sawmills of this country are 160 per cent overdeveloped—the installed capacity is 117,500,000,000 board feet per annum whereas the actual production does not exceed 46,000,000,000 board feet. This alone is sufficient proof that no lumber monopoly could successfully function in the United States with between 30,000 and 40,000 separate producing units.

ARBITRATION AND SETTLEMENT OF CLAIMS

History.

The settlement of business disputes by arbitration has been attempted with more or less success in all lines of business, and since the World War there has been a great awakening to the advantages of this method. Disputes have been common and of long standing in the lumber industry. Lumber is a commodity with many variable factors, such as condition, appearance, growth, species, weight and defects; and while a few practices, based upon long experience and custom, have been accepted in legal form, they have not had the common acceptance that seems justified.

Among the advantages of commercial arbitration and the settlement of disputes by submission to a board or commission, may be mentioned the following:

1. The relative simplicity of arbitration procedure as compared

with settlement by litigation in the courts. The latter invariably proves to be expensive and long delayed.

2. The relative inexpensiveness as compared to litigation.

3. The fact that buyers and sellers of lumber located at great distances from each other can settle differences with the greatest celerity and with justice to both parties.

It is true that the average firm or individual invariably looks upon the merits of his case from a prejudiced point of view. Babson, the statistician has said, " Business is good or bad according to the character of the people, the character of the employers, the character of the merchants and jobbers, the character of us all."

Commercial arbitration has been more generally adopted in connection with foreign trade than with domestic business. The great reason for its adoption was the distance between buyer and seller and the necessity of building up some organization or method of handling disputes.

As the wholesaler distributes from 60 to 80 per cent of all the lumber produced in this country, he is naturally interested in arbitration to a greater extent than either the manufacturer, retailer, or ultimate consumer. That is, in a sense he is a " go-between " and not only handles financial matters, but is responsible for shipments between the mill and the purchaser.

The National American Wholesale Lumber Association has made arbitration one of its principal tenets and has already done an important work in handling arbitration cases not only between its own members but between its members and others. In many cases it has handled disputes in which neither of the parties were members of the Association.

Principal Sources of Claims and Disputes.

The following are the principal sources and reasons for disputes:

1. Incomplete orders. A surprisingly large number of orders are lacking in some of the essentials, such as questions of time of shipment, grade, terms of payment, specifications, etc. In many cases these details are left to interpretation and oftentimes they are either improperly understood or interpreted according to the advantages which would accrue to buyer or seller.

2. Improperly executed orders. Among the principal sources of dispute are failure to ship on time or failure to ship stock of the grade, size, condition, dressing, or kind, as ordered or understood by the buyer.

3. Insufficient count or tally on arrival. In many cases the measurement at destination does not agree with the specifications at loading point.

4. Cancellation of orders. During depressions buyers sometimes cancel orders because they can purchase elsewhere at a lower price. On the other hand, mills or wholesalers will sometimes cancel orders because they can sell elsewhere on a rising market to better advantage. Cancellations may be handled in any of the following ways:

A. When buyer cancels he may be forced to accept the lumber in spite of cancellation. This procedure, however, has proved to be difficult to enforce, and furthermore, business relations are generally severed in this instance.

B. The mill may resell for buyer's account upon due notification.

C. The mill may accept cancellation in the hope of retaining the buyer's favor for future business, and make other disposition of the lumber.

Methods of Settlement.

The only possible methods of settlement of disputes in the lumber industry are as follows:

1. By compromise.
2. By litigation.
3. By arbitration.

Compromise has usually proved to be ineffective and unsatisfactory. Generally speaking, the fault or breach of contract lies with one party or the other, and if it is settled by compromise one party feels that he has been injured. This is not conducive to the best business relations.

Litigation is generally exceedingly expensive to both parties involved. Long delays are inevitable; both parties generally feel that they have been wronged, irrespective of the outcome; and future relationships are generally abandoned.

Compulsory arbitration has no doubt proved to be more satisfactory, and such organizations as the United States Chamber of Commerce and the International Chamber of Commerce have made provisions for arbitration of business disputes in many of the more important industries.

By the method of arbitration long-standing customs in the trade are recognized. For example it is understood that unless stated time is specified in the order, prompt shipment means shipment within sixty

days. Furthermore, the manufacturer is usually given leeway of 5 per cent for off grade. It is generally the rule that concerns which believe in fair terms, honest grades, and the proper fulfillment of all obligations and contracts are not averse to settlement of disputes by arbitration, and it may be inferred that concerns which do not observe the best ethics of lumber distribution are unwilling to submit their cases to arbitration.

Too many disputes have arisen over the question of fixation of responsibility to ship. When a manufacturer or wholesaler accepts a contract to ship certain lumber he too often has claimed car shortage, labor difficulties, inability to secure logs, mill breakdowns, etc., as a reason for non-shipment. This and many other bases of disputes have been amicably and satisfactorily settled by arbitration. The principle of arbitration should be adopted universally by the lumber industry, as a great many disputes now occurring throughout all branches of the industry could thus be eliminated.

Typical Examples.

The following[1] are typical examples of the settlement of disputes by arbitration as effected by the National American Wholesale Lumber Association. They present four representative questions over which disputes have arisen, giving the essential facts and the decision in each case.

RIGHT OF TOTAL REJECTION OF SHIPMENT PARTLY OFF-GRADE

The Facts

A Southern Wholesaler, hereinafter referred to as the Seller, sold to and shipped on the account of a Northern Wholesaler, hereinafter referred to as the Buyer, a car of 1×6 No. 2 Common S2S and CM. The Buyer in turn sold the same to a Retailer. Upon arrival the car was rejected on account of grade, whereupon arrangements were made to have the car unloaded, stored, and officially inspected.

In requesting that the shipment be officially inspected, the Buyer wrote the Seller in part as follows:

"This lumber was sold you as No. 2 Common, and we claim that it is No. 2 Common according to the specifications of the Southern Pine Association, and if the Association inspection shows it is up to this grade, we expect you to accept it as invoiced, but if the inspection shows that it is not up to grade, we will then arrange other disposition."

[1] These were selected, as being the most typical and usual arbitration cases, by Mr. Fred Larkins, formerly Assistant Secretary, American Wholesale Lumber Association, Chicago, before its amalgamation with the National Wholesale Lumber Dealers' Association.

The official inspection report showed the following results:

15,809	feet	No.	2	Common	Y.P., S2S&CM	on grade
939	"	"	1	"	" "	above grade
2,788	"	"	3	"	" "	below grade
5	"	"	2	"	Car Siding, not ordered	
91	"	"	2	"	Poplar, not ordered	
12	"	"	3	"	Poplar, not ordered	
22	"	"	2	"	Oak, not ordered	

The Dispute

The report showing approximately 15 per cent of the shipment being off-grade was considered as not being up to grade under the 5 per cent Rule of the Southern Pine Association, and on this account the Buyer abandoned the shipment to the Seller. The Seller contended the Buyer should accept and pay for the portion up to grade at invoice price, the Seller to make disposition of the balance, on the ground that Buyer was not justified in rejecting the entire shipment, inasmuch as a sufficient quantity was found to be up to grade to make a minimum carload.

The Decision

HELD, that reinspection showed carelessness in the original inspection by the Seller and an indifference to his customer's interests.

Held further, that in view of the facts stated the Buyer was within his legal rights in rejecting the entire shipment; that Seller should take possession of the shipment assuming all charges which have accrued, or may accrue against the same, and to refund to the Buyer all moneys which the latter has advanced to the Seller on the same.

However, it is held further, that the Buyer should have shown more interest in aiding the shipper to dispose of the car and less anxiety to take advantage of the technical and possible legal aspects of the case. Being on the spot he could best dispose of the stock and should be vigilant in protecting the full interests of the shipper, even at the sacrifice of time and money.

The foregoing decision involves a practice which we are informed has become quite general in the lumber industry during periods of a declining market, and considerable criticism is made of it as being unethical. Our Arbitration Committees are required to give full weight and consideration to the respective legal rights of the parties involved in a controversy, as well as the facts. Failure to do this would only operate, as it frequently has in the past, against arbitration as a method of adjusting trade disputes. We understand the decision in this case was reached pretty largely on legal grounds, although from an ethical standpoint it is observed that the practice is condemned as being unfair and unjust.

WHOLESALER'S OBLIGATION TO HIS CUSTOMER TO SHIP IN TIME AGREED

The Facts

On April 12, 1921, a northern buyer sent an order to a southern wholesaler for a car of No. 1 Common Selects Plain Red Gum for shipment "at once." Seller accepted the order promptly for shipment "at once."

Then followed considerable correspondence during April and May wherein Buyer repeatedly urged Seller to make shipment and the latter repeatedly promised early delivery. On June 3 Buyer wrote Seller bringing specific attention to the long delay and insisted that quick shipment must be made.

Not having received invoice, Buyer notified Seller on June 15 that unless the latter gave him car number inside of ten days, Buyer would then purchase elsewhere for Seller's account. Seller replied on June 18th bringing attention to numerous difficulties he had had with his mill connections in connection with the execution of the order, but that he would surely wire car number within the following week. Shipment was not made within that time and therefore Buyer purchased car elsewhere at a loss of $45.59, sending Seller a bill therefor on July 6. Seller then advised that he had the car ready in accordance with previous promises and insisted that Buyer accept same.

The Dispute

The Buyer contended that, having allowed the order to remain with Seller more than sixty days, he had thereby given him ample time within which to fill an order for shipment "at once." Furthermore, that having given Seller an additional ten days' grace, Buyer insisted that he was well within his rights in purchasing elsewhere for Seller's account. Therefore, Buyer contended he should not be required to accept shipment from Seller after June 25th, and that his bill for loss incurred through replacement should be paid. Buyer furthermore contended, that Seller alone was responsible to him for proper execution of the order and that he was in nowise interested in or responsible for the difficulties Seller might have had with his mill connections.

The Seller's contention was that his mill connection suffered considerable delay in the execution of the order for causes beyond its control, that the stock called for in the order was very scarce in that section so that it was not convenient for him to secure same elsewhere and that, therefore, he should not be held responsible for the delay. Seller insisted that he had put forth a fair effort towards executing the order as originally contemplated and felt that Buyer was, under all the circumstances, unreasonable in canceling same, particularly after Seller had finally succeeded in replacing it for early delivery. Therefore, seller contended that he should not be held liable for loss incurred through Buyer's repurchase, nor suffer loss of profit through cancellation.

The Decision

IT IS HELD 1st: There was no dispute as to the fact that the original contract called for shipment "at once."

2d. Buyer, having allowed Seller a period of sixty days within which to make shipment, thereby gave more than reasonable consideration to Seller on an order accepted for shipment "at once."

3d. Failure to ship within a reasonable time renders Seller responsible for any loss thereby incurred by the Buyer. Therefore, Buyer, in purchasing elsewhere for Seller's account, was entirely within his rights, he having waited sixty days for shipment and given due notice of his intention to take such action.

4th. That price paid by Buyer in repurchasing the car, which was $3.00 per thousand in excess of the original contract price, represented the fair market value of the stock in question at the time of repurchase.

IT IS THEREFORE HELD, that Seller should pay Buyer the amount of loss incurred, $45.59, as claimed, together with interest thereon at 6 per cent from July 6, 1921.

IT IS FURTHER HELD, that the Seller in this case, being a wholesaler with access to many stocks of lumber at different mills, and with knowledge of the grades sold by them, did not show proper diligence towards making delivery within the time agreed upon. Failure on Seller's part to secure the material from one mill did not prevent

his securing it from some other shipper, which Seller should have done under the terms and conditions of the contract.

IT IS HELD FURTHER, that the prime function of the wholesaler was violated by the Seller in this case, as the Buyer is not responsible for the difficulties which may arise between a wholesaler and his mill connections. The wholesaler should fulfill his contracts regardless of conditions that may arise with his source of supply, unless the contract calls for the stock of a specific mill, and wherein due knowledge has been given the Buyer as to the source of supply and the conditions under which such mill might operate.

BUYER LIABLE FOR LOSS RESULTING FROM CANCELLATION WITHOUT JUST CAUSE

The Facts

On April 30, 1920, the buyer, a wholesaler, purchased from the seller, a manufacturer, one car 1-inch Select Cypress Rough with the understanding that shipment would be made at once upon receipt by seller of buyer's shipping directions and that the latter would be furnished as soon as the then existing embargoes on Eastern points were raised.

Nothing further transpired until July 29, 1920, on which date seller wrote buyer demanding that shipping directions be given immediately. Similar requests without favorable response were made on August 4, October 4, November 18 and 26, and on December 24. On the latter date seller advised buyer that unless shipping directions were supplied immediately, seller would proceed to dispose of the stock to best advantage for buyer's account. On December 31 buyer wrote seller canceling the order. Seller replied on January 3, 1921, refusing to accept cancellation and demanding that buyer reimburse seller for difference between the contract price and the then market value of the stock, enclosing bill therefor. Payment was promptly refused by the buyer.

The Dispute

The seller contends that after having waited eight months for shipping directions and the embargo having been raised for several months, during all of which time they were prepared to make shipment, and having urged that buyer give them shipping instructions in order that they might do so, and having at no time done anything that would give buyer just or legal cause for cancellation, they were, therefore, clearly entitled to damage for breach of contract on part of buyer.

Buyer contends that they were unable to furnish shipping instructions, due to embargoes for some time after purchase was made, and finally were obliged to repurchase from another shipper from whose territory shipments were not at the time embargoed. Buyer points out that the price of the stock continued to advance, and having been unable to supply shipping instructions to seller, naturally assumed that the latter had made other and more favorable disposition, and was not depending upon buyer to complete the contract. Buyer furthermore contends that seller should not have retained the order until the price had declined without declaring his intention of making other disposition, thus leading buyer, as stated, to believe that such action had been taken.

The Decision

It is found (1) that seller was at all times prepared to carry out his part of the contract, but was not permitted to do so by buyer, through buyer's failure to supply

shipping instructions, and that embargoes were raised several months prior to cancellation, thus removing that condition in the contract. (2) That the order remained in full force and effect until January 3, 1921, on which date seller received buyer's cancellation. (3) That buyer breached the contract of sale, and is, therefore, liable to seller for damage resulting therefrom, such damage being the difference between the true market value as of January 3, 1921, and the original contract price. (4) That the fair market value of the stock involved as of January 3, 1921, was $12 per 1000 feet less than the contract price and that a fair average carload is 15,000 feet. It is therefore

HELD. That buyer is liable to seller for damage at the rate of $12 per 1000 feet on 15,000 feet or the total sum of $180 with interest thereon at the legal rate from January 3, 1921.

COMMISSION MEN DO NOT HAVE IMPLIED AUTHORITY TO BIND BUYER OR SELLER

The Facts

On February 4, 1922, a Northern Commission firm, hereinafter referred to as the Salesman, sent out a list of orders they desired to place. Item No. 9 of this list read as follows:

"3 cars 4/4×6 and wider B & Btr., Smoke Dried Y.P. Rough Finish Short Leaf Random lengths at $32 F.O.B. mill."

On February 6, the seller, a Southern manufacturer, wired acceptance. Salesman confirmed by wire and formal order same day, sending copy to buyer, a local wholesaler.

On February 8, buyer mailed seller their regular order confirming. Among other conditions of buyer's order, which were duly incorporated therein, it was provided that all stock must be well manufactured and "neatly end-trimmed," also that Southern Pine Association estimated weight was guaranteed by Seller.

On February 8 seller acknowledged receipt of order as received from salesman on their regular acknowledgment form, which contained no specifications as to trimming or as to guarantee of weights on stock sold F.O.B. mill. No acknowledgment was made of buyer's formal order though it was received.

Shipment consisting of 14,707 feet was made on February 22.

On March 22, buyer sent seller final settlement on the car after deducting $69.84 which represented the difference between the actual freight charged and what it would have been based on Southern Pine Association estimated weight of 3200 lbs. per 1000 feet.

Buyer wrote seller enclosing settlement and explained that weight charged was about 4500 pounds per 1000 feet, hence apparently a railroad error, and that, if seller desired, buyer would file claim for his account.

Seller promptly declined the settlement on the ground that he had not guaranteed the weight and furthermore that the Southern Pine Association schedule did not provide an estimated weight on smoke dried finish but only on steam dried. Buyer refused to accept this view. Subsequent investigation developed the fact that report from final consignee showed tally practically exact as invoiced, and that the stock was "fine lumber, same being thoroughly kiln-dried and of a soft texture." Also that it was sawed good thickness but not end-trimmed which undoubtedly caused some excess weight. Also that some of the 16-foot lengths still on hand measured from 6 to 13 inches over length.

The Dispute

Buyer contended (1) That their order provided specifically that stock was to be well and evenly manufactured and that seller was to protect association weight. (2) That if seller objected to any of the provisions of their formal order of February 8 he should have so advised buyer and withheld shipment pending an agreement. (3) That the Southern Pine Association schedule of weights did not differentiate between methods of kiln-drying but merely provided a weight applicable to kiln-dried stock. (4) That stock was improperly manufactured in that the sizes were excessive both in thickness and length, as per destination report, which caused excessive weight.

Seller contended (1) That the contract was evidenced by salesman's formal order and their acceptance of it in neither of which was any reference made to either manufacture or weight. (2) That stock was well manufactured according to the rules and thoroughly dry as shown by the report from destination. (3) That they never guaranteed weights on F.O.B. shipments as a matter of fixed policy of long standing. (3) That it is not customary in the trade for seller to guarantee weights in the absence of specific agreement to that effect. (5) That buyer's formal order was received after contract was closed with buyer's agent and no particular note was taken of it except to check up the shipping directions to see if any changes were desired. (6) That smoke-dried finish contains a greater moisture content than steam-dried, hence weighs more and therefore the same estimated weight should not be applied to both.

The Decision

It is found: (1) That Commission men under the established customs and practices of the lumber trade are not presumed to possess the authority to bind either the buyer or the seller, except subject to the confirmation or approval of the principals. The function of Commission men is to endeavor, as brokers, to bring the buyer and seller together on a common basis, subject to their respective confirmations. Therefore no valid and binding contract can be said to exist unless and until the proposed agreement has been duly confirmed by the parties thereto. (2) The buyer in this case upon being advised by the Commission man of seller's willingness to accept the order in question, sent seller their confirming order setting forth the particular terms and conditions under which they would confirm the purchase. This in effect was a formal offer from buyer to seller. The seller admits having received buyer's formal order or offer promptly but did not examine it carefully, except as to the shipping directions. Neither did he acknowledge receipt of buyer's formal order or object to its terms and conditions, but made shipment thereon, and rendered buyer an invoice therefor on which buyer's order number was shown. The seller thereby accepted buyer's formal order or offer and thus concluded a contract whereby he bound himself to all of its provisions. (3) That the contract thus concluded provided that the Southern Pine Association weight for Dry Finish was guaranteed by Seller. (4) That such weight is 3200 pounds per 1000 feet irrespective of the method of drying, the weight being based on stock of the proper moisture content for dry lumber. (5) That buyer was therefore entitled to credit for all actual freight charges paid on the weight in excess of 3200 pounds per 1000 feet, as shown by expense bill. (6) That such excess amounted to 14,400 pounds at 48½ cents per 100 pounds, or $69.84. Therefore,

IT IS HELD. That buyer is entitled to credit for excess freight paid in the sum of $69.84, as per deduction made by them in settlement.

COST ACCOUNTING

Although cost accounting in the lumber industry has been applied chiefly to the logging and manufacturing branches, where the need for it has been largely felt, it has come to be applied to the selling departments of manufacturing, wholesaling and retailing companies as well. Formerly little attention had been paid to the actual cost of selling per thousand board feet. Many retailers' organizations have been very efficient in installing cost accounting systems among their members. Wholesalers' organizations have not generally taken this up as an association effort, but each wholesale company usually has its own method of determining the costs, returns and profits on each transaction. The accompanying diagram illustrates a common method of accounting for the costs and receipts on a single car transaction by a wholesale concern.

WHOLESALERS' COST ACCOUNTS

Disbursements

Date of shipment, January 10, 1923.
Shipper—John Jones, Coleville, Ala.
Shipped from Coledale, Ala.
NYC No. 123678—6,021 pcs. 2×4 10–20 feet, No. 1 common yellow pine D2S1E

Invoice price, F.O.B. Coledale, Ala		$313.22
Less discount		6.26
Net invoice price		$306.96
Shippers' draft for 80 per cent, 1/15/23	$250.58	
Balance paid 2/11/23 by check No. 8134	56.38	
	$306.96	

Receipts

File No. 05000.
Sold to Glomar Mfg. Co., Rochester, N. Y.
Our order No. 627, their order No. 1831.
6,021 pcs. 2×4, 10–20 feet No. 1 common yellow pine D2S1E.

Invoice price, F.O.B. Rochester, N. Y.		$616.11	
Less freight paid by customer		206.01	
		$410.10	
Less discount		8.20	
Received check 2/11/23		$401.90	
Received			$401.90
Cost			306.96
Profit			$94.94
3/28/23 refund from NYC Ry. a/c frt			8.16
Total profit			$103.10

ADVERTISING

Nowhere in the world has the art of advertising been developed to such an extent as in America. The lumber industry was the last big American industry to adopt advertising. For a long time there was a theory to the effect that lumber was such a well-known and commonly used commodity that there was no need of advertising its particular qualifications and advantages. Manufacturers did not come in contact with the consumer; hence they felt that there was little need for advertising.

On the other hand, until a few years ago the ultimate purchaser and consumer knew little about the various properties of wood. Advertising has begun to change this condition, and its financial results are now generally recognized. Manufacturers, wholesalers, and particularly retailers now very frequently make use of advertising, and considerable cooperation between manufacturer and retailer has been brought about to the advantage of both branches of the industry.

The campaign for more effective advertising in the industry really began in 1912 with the agitation by the National Lumber Manufacturers' Association for a forest products exposition in New York and Chicago. Prior to that date the manufacturers and jobbers of wood substitutes by the use of widespread advertising, had made serious inroads into the lumber business and it was felt by the more progressive element that it was time better methods in advertising were adopted.

The Southern Cypress Manufacturers' Association has been the pioneer association in advertising and began its efforts along these lines as early as 1894. Its advertising was predicated on the theory that the ultimate consumer should be informed of the uses for which cypress is best adapted. The durability of this species, so well known to lumbermen, was brought before the attention of the general public, and the advertising profession point to the advertising program by the cypress manufacturers as one of the signal and outstanding examples of successful advertising.

In 1915 the National Lumber Manufacturers' Association established a trade extension department to increase the use of wood, leaving to original manufacturers' organizations the campaign for educating the public as to the advantages and value of their particular species. Very shortly thereafter the Southern Pine Association adopted a very active and successful advertising campaign which resulted not only in an increased use and demand for the products of the Southern Pine mills,

but also had a very salutary effect upon the manufacturers and retailers of southern pine in a greater appreciation of the woods they were producing or handling. Advertising since 1912 has been actively carried on, with excellent effect, not only by associations representing one or a group of species but by individual lumber manufacturers, individual wholesalers and retailers throughout the country.

The principal media for advertising have been the lumber trade journals, the popular magazines, newspapers, etc., but these have been greatly supplemented by the use of national and regional association and individual exhibits at national, state and county fairs and expositions throughout the country.

Examples of successful group advertising are shown in the merchandising of the following species: Cypress, southern pine, redwood, birch, walnut, red gum, and maple and oak flooring.

Examples of successful individual advertising are furnished by the following companies: Weyerhaeuser Sales Company of St. Paul and Spokane, Long-Bell Lumber Company of Kansas City, Shevlin, Carpenter & Clark of Minneapolis, The Great Southern Lumber Company of Bogalusa, the Red River Lumber Company of Westwood, California, and many others.

The influence of the lumber trade press has been exceedingly important. Without doubt, some of the most effective advertising has been placed in lumber journals, which reach not only the retailers and wholesalers but also purchasing agents and officers of railroads, mining companies, contractors, architects and large industries such as furniture and car construction, box factories, etc., which are active purchasers of lumber.

The use of brands and trade-marks is a much more recent development. In Sweden and other important lumber-exporting countries, the use of brands and trade-marks, to identify the mill of origin and the species and grade, has been common for many years.

CHAPTER IX

SHIPPING AND TRAFFIC

FREIGHT RATES

CONGRESS has granted to the Interstate Commerce Commission the right to fix and change from time to time interstate freight rates on common carriers. These vary with the different commodities, and for lumber and other forest products there is a group commodity rate which is determined for each originating point to destination. There is no correlation between distance and rate. Generally speaking, long hauls are cheaper per ton mile than short hauls.

According to reports of the Interstate Commerce Commission, the American railroads hauled, during 1922, over 114,000,000 tons of lumber, timber, etc., and the total tonnage of forest products carried was over 172,000,000. This volume of traffic represented, in one year, 10.23 per cent of the total amount of traffic handled by the railroads, and exceeded in importance the tonnage of such other important commodities as animal products, general merchandise and all the products of agriculture. In fact, it exceeded every other kind of commodity except bituminous coal in total volume or tonnage.

According to the same commission, the freight receipts per ton were $4.03, yielding an annual revenue of more than $359,000,000. The revenue per car for the country as one system in 1922 was $111.57.

Statistics show that the average length of haul for carloads of lumber was 175 miles, whereas the average length of haul for grain was 226 miles, hay 139 miles, cotton 201 miles, live stock 212 miles and bituminous coal 133 miles. The length of haul adds directly to the cost of lumber delivered at any given point, and therefore lumber is consumed as near as possible to the point at which it has been produced. But even with this obvious axiom in mind, there is a rapidly increasing average length of haul from the producing sawmills to the great centers of consumption.

Freight rates for lumber are based entirely upon weights and are expressed in cents per hundred pounds. All lengths, kinds, and conditions of lumber, with a few exceptions, must pay the same rate. This

is regarded in the industry as a very big factor in waste. Low grades of lumber, which can be purchased very cheaply at the sawmills, cannot stand high freight rates and long hauls to market, whereas high grades or expensive lumber carrying the same rate of freight can be moved to market to much better advantage. It is true, however, that in some cases, as in that of western red cedar, which is a light lumber, a much higher rate of freight is in effect than with heavier lumber such as Douglas fir.

There is, also, a sharp distinction between ocean rates for heavy and light hardwood lumber, the variation for light-weight species being sometimes as high as 30 to 50 per cent above that for the heavier hardwoods.

Transportation costs, therefore, add very greatly to the costs of lumber at the consuming point. In many instances the cost of transportation even exceeds the cost F.O.B. mill.

As about 46 per cent of all lumber produced in the United States is used by farmers, the long hauls from our timber regions to our great sources of agricultural supplies are a very important factor in the economics of lumber transportation.

Water and canal rates are playing a very important part in the movement of lumber and compete actively with rail transportation. This is particularly true along the Gulf, Atlantic, and Pacific coasts, through the Great Lakes, the Mississippi and its tributary system, the New York State Barge canal and the many other canal and river systems throughout the country. For example, the coastwise rate via the Panama canal from points on Gray's Harbor, Willapa Bay, and Puget Sound, to New York City and other northern Atlantic ports is about $10 to $15 per thousand feet, whereas the rail transportation rate at 90 cents per hundred pounds means an expenditure, for the movement of Douglas fir between the same points, of $24 to $30 per thousand board feet, depending on the size, grade and method of dressing. Large quantities of white pine are transported from Minnesota and Georgian Bay to Buffalo and the Tonawandas and are also moved to eastern Canada and points in the East via this method. Considerable quantities of yellow pine are moved from the Gulf and South Atlantic points to the great consuming centers of the northern Atlantic ports, such as New York, Boston, Baltimore, Philadelphia, Portland, and Providence. There is a very heavy movement of lumber from the northern Pacific points, including those mentioned above, and from the Columbia River points, Coos Bay, Oregon, and Humboldt Bay in northern California

to San Francisco Bay points and to the rapidly developing sections of southern California. The last-named sections have consumed enormous quantities of lumber and have remained active through a period of many years, during which there have been many booms and depression in other parts of the country with resulting rise and fall in lumber prices.

Following the period of the Great War, logging and sawmill costs, after a sharp rise, were rapidly deflated, and with this the F.O.B. mill prices dropped rapidly, in fact, close to pre-war levels; but railroad freight rates, which rose rapidly after the war, have not dropped proportionately. The cost of lumber to the consumer, therefore, on account of the heavy burden of railroad and water freight rates, has often been erroneously charged to the lumberman whereas it should be charged to the general economic condition of the country and the need of proper support for the railroads.

Freight rates determine the limitations of competition to a very large degree. For example, North Carolina pine can only compete in the markets as far west as Central Ohio, because beyond this point excessive freight rates prevent its competing with lumber coming from the South or from the North. The great disparity between the rail and water rates from Pacific Coast producing points to the Atlantic ports means that only high-grade finish, flooring, shingles, and the more expensive grades required for prompt delivery can withstand the high rates for rail movement.

The following table[1] shows the weights of typical grades of some of our chief species and the influence of different rates, in cents per 100 pounds in carload lots, from points of origin to the two great lumber markets of the country. In particular, they show how the costs of transportation per thousand feet have advanced since the war. In the first column are shown the cost of transporting lumber before rate advances went into effect; the second shows the important advance in June, 1918; and the third, the rates which were in effect for a considerable period after that date (corrected to 1923).

FREIGHT CLAIMS

The lumber industry uses about 3,000,000 cars in a normal year, and complications and mistakes in the application of freight rates and regulations are more or less frequent. Mistakes give rise to the impor-

[1] Taken from data supplied by the National American Wholesale Lumber Association.

RATES IN EFFECT AND COSTS OF SHIPPING LUMBER PER 1000 BOARD FEET

Shipping Points.	To New York, N. Y.			To Chicago, Ill.		
	May, 1918.	June 25, 1918.	1923.	May, 1918.	June 25, 1918.	1923.
Norfolk, Va.—Rate	13.70¢	18 50¢	23.30¢			
Roofers, 2500 pounds	$3.43	$4 63	$5.83			
Flooring, 2250 pounds	$3 08	$4 16	$5 24			
1-inch boards, 3100 pounds	$4.25	$5.74	$7.22			
Hattiesburg, Miss.—Rate	33.00¢	39 00¢	47.00¢	25 50¢	31.50¢	38.00¢
Yellow pine, rough, 4500 pounds	$14.85	$17.55	$21.15	$11.48	$14.18	$17.10
New Orleans, La.—Rate	35.00¢	41.00¢	49.00¢	25.50¢	31.50¢	38.00¢
Cypress, 3000 pounds	$10.50	$12.30	$14.70	$7.65	$9.45	$11.40
Memphis, Tenn.—Rate	31.00¢	37.00¢	44.50¢	18 50¢	24.50¢	29.50¢
Oak, 4000 pounds	$12 40	$14 80	$17.80	$7.40	$9.80	11.80
Gum, 3300 pounds	$10 23	$12.21	$14 69	$6.11	$8.09	$9.74
Cottonwood, 2800 pounds	$8.68	$10.36	$12.46	$5.18	$6.86	$9.10
Cloquet, Minn.—Rate	33 00¢	39 00¢	47 00¢	12.00¢	15.00¢	18.50¢
White pine, 2500 pounds	$8.25	$9.75	$11.75	$3.00	$3.75	$4.63
Pacific Coast Group.—Cedar rates	85.00¢	90 00¢	103 50¢	67.00¢	72.00¢	84.00¢
1-inch finish, S2S, 1800 pounds	$15 30	$16.20	$18.63	$12.06	$12.96	$15.12
Fir rates	75.00¢	80.00¢	90 00¢	55.00¢	60.00¢	72.00¢
Rough timbers, 3300 pounds	$24.75	$26 40	$29.70	$18.15	$19.80	$23.76
Small timbers, 2800 pounds	$21.00	$22.40	$25 20	$15.40	$16.80	$20.16
1-inch finish, 2500 pounds	$18.75	$20.00	$22.50	$13.75	$15.00	$18.00
Spokane Group—Cedar rates	82.00¢	87.00¢	100.50¢	64.00¢	69.00¢	80.50¢
1-inch finish, S2S, 1800 pounds	$14.76	$15.66	$18 09	$11.52	$12.42	$14.49
Fir rates	72.00¢	77 00¢	87.00¢	52.00¢	57.00¢	68.50¢
Rough timbers, 3300 pounds	$23.76	$25.41	$28.71	$17.16	$18.81	$22.61
Small timbers, 2800 pounds	$20.16	$21.56	$24.36	$14.56	$15.96	$19.18
1-inch finish, 2500 pounds	$18.00	$19.25	$21.75	$13.00	$14.25	$17.13

tant subject of freight claims, which may be of two kinds, namely (1) overcharge claims, and (2) damage and loss claims.

Overcharge Claims.—The question of overcharge is fundamentally one of rate fixation and computation therefrom. The sources of errors which affect the amount of charges for shipments may arise from the following:

(*a*) Loss of identity. Shipments are frequently rebilled en route and mistakes made in the application of rates from original and rebilled points to destination.

(*b*) Confusion in billed destination. Mistakes often result from confusion in location of a city with respect to its nearest "Key Rate City."

(*c*) Wrong dating. The date of delivery of a shipment and not the waybill date is considered in case of advancing rates.

(*d*) Substitution of larger or smaller car for order. This often means a charge for excess loading.

(*e*) Switching at destination.

(*f*) Verified or incorrect classification. The consignee should check up the abbreviations on bills of lading, since confusion in these abbreviations may cause collection of a rate based on a mistaken classification.

(*g*) Weights. Where estimated weights are not in use there often arise overcharges, due to errors in the gross weight, resulting from weighing while coupled in trains or even while in motion.

(*h*) Wrong tariffs, inaccurate combinations of rates and wrong division of percentages among carriers. Rate clerks are unfortunately careless in applying tariffs.

(*i*) Errors in reconsigning and transit charges.

Damage and Loss Claims.—The carriers are responsible for proper care and protection of lumber from the time it is loaded to the time of delivery to consignee. Damage due to defective cars supplied by the railroad, loss of shipment in wrecks, stray billing, or similar causes fall under the carrier's responsibility. Loss in transit may be due to carelessness, robbery, accidents, or straying. The railroad always reserves the right to refuse shipments unless they are properly loaded or protected.

Claims for damage or loss must be made according to the clause in the uniform bill of lading within six months after delivery, or in case of non-delivery within six months after a reasonable time for delivery has elapsed. Suits for recovery must be instituted within two years and one day.

Forms for presenting claims for damage or loss and overcharges have been compiled by the Interstate Commerce Commission and are now in general use.

Lumber trade associations are often of great assistance in obtaining settlements for overcharge, damage, and loss claims for their members. This work is one of the most important functions of the traffic departments of these associations.

DEMURRAGE AND STORAGE

Demurrage is the penalty imposed by the railroads for cars held by or for the consignor or consignee for the purpose of loading, unloading, or reconsigning, or for any other purpose. It is intended to discourage unnecessarily long delays in loading, or unloading, or in holding the cars for any purpose.

Demurrage charges vary somewhat but, generally speaking, the free time allowed for loading and unloading is two days. If for any reason cars are detained beyond this period, a charge of $2 per day is made for each of the first four days and $5 per day for each day thereafter. In computing the time, free time commences from the first 7 A.M. after placement on delivery tracks or after the day on which arrival notice is sent or given to the consignee.

If, after a given time, which varies with the different railroads, the goods are not claimed or unloaded, the railroad unloads the car and stores the goods at the expense of the consignee. If the goods are not claimed in one year they are auctioned off at public sale to pay for cost of unloading and storage.

The Interstate Commerce Commission has recently permitted an increase in storage charges, in order to discourage the practice of demurrage and storage. Railroad storage facilities are generally very limited. The average storage charge by private companies is about $10 per car per month, but the railroad charges are still higher, often from $10 to $50 per month.

Demurrage is usually unpreventable, but on occasion may be deliberate. In times of car shortage the consignee may sometimes delay the unloading of a car until he is able to load it with his own goods.

WEIGHING SERVICE

Carloads are usually weighed at the point of loading. However, if no scales are available, weighing is done en route at the first available

scales. In all railway traffic territories, the acceptance of a general weight agreement is in effect. This is based upon shippers' weights which in turn are checked up and policed by various local weighing associations which are recognized by the common carriers.

TRANSIT SHIPMENTS

During periods of relative inactivity or whenever the manufacturer's yards are overcrowded and congested or he is in urgent need of funds, carloads of lumber, generally made up of sizes and grades in frequent demand, are shipped to the principal markets in the hope that they can be sold prior to arrival. In case they are sold at some other point they can be diverted, provided they have not passed beyond certain diversion points en route.

In all cases it is necessary to make transit arrangements in advance, otherwise reconsignment charges are in effect. If the car arrives at the destination given in the bill of lading and is rebilled to some other point, the through rate from point of loading to final destination is put into effect, plus the transit charges. This is only true, however, in case reconsignment instructions have been filed prior to arrival of car at original billed destination.

RECONSIGNMENT

Reconsignment is a service extended by the carriers to shippers, under which goods may be forwarded to a point other than the original billed destination without removal of contents from the cars. A through rate or combination of rates is charged when the bulk is not broken and no advance arrangements have been made as in the case of transit cars. The charges vary slightly with the different railroads but generally are about the same. On some of the principal systems a charge of $2.70 per car is made when the car is reconsigned prior to reaching diversion point. After destination is reached there is a charge of $6.30 on each car. These charges vary, however, with the different systems and from time to time with the changes of freight rates.

Under reconsignment or diversion regulations, the through rate is charged from the point of origin to final destination with the following provision. If reconsignment is not made promptly, demurrage charges, as outlined above, are in effect. Cars for reconsignment are placed in storage, or "hold," tracks.

The primary economic effect of reconsignment occurs in the increase

of fluidity and regularity in the movement of goods. There is an important elimination of waste in the handling of commodities between producer and consumer. Celerity of movement is increased, the direction of commodities to the point of the most active demand is facilitated and over-supplies at congested centers are avoided.

MILLING IN TRANSIT

Milling in transit, as applied to lumber, refers to the stoppage of cars between loading point and destination in order to perform some manufacturing, handling, or treating process. This is of great advantage to wholesalers who purchase lumber in the rough from small manufacturers or portable sawmill operators and who wish to have stock dressed or worked to certain specifications en route to their customers. Common carriers have therefore permitted the unloading and reloading of cars for the following purposes: Assorting, burnettizing, concentrating, creosoting, diverting, dressing, drying, grading, inspecting, manufacturing, milling, piling, resawing, splitting, trimming, working and hardening, etc. In actual practice it applies chiefly to milling done on cedar posts and poles, on all kinds of lumber and timbers which may be remanufactured, dressed or worked to given specifications, and to grading mill-run stock.

The same charges are in effect as in transit shipments and demurrage charges apply. However, there is a so-called " average " agreement, whereby if in unloading a saving of one day is effected the shipper is granted an extra day in which to load; that is, the shipper receives credit for rapid unloading, loading, etc.

Railway regulations and records are very complicated as appertaining to rules covering milling in transit. The traffic manager must be very expert in his knowledge of regulations and freight rates, in order that cars may be stopped at certain points for milling in transit without affecting the through rate. In other words, not all points have the advantage of through rates.

WHARFAGE

Wharfage is a charge collected on lightering of shipments to and from shipside. It may also refer to the use of wharves or docks in loading or unloading water shipments. Charges are generally made on the basis of ton weights, although in some cases they are made on the basis of thousands of board feet. For example, in export shipments, there is generally a wharfage charge at such ports as Houston, New

Orleans, etc., while wharfage charges are generally absent in such ports as Pensacola and Mobile. In New York, lighterage is free; that is, the

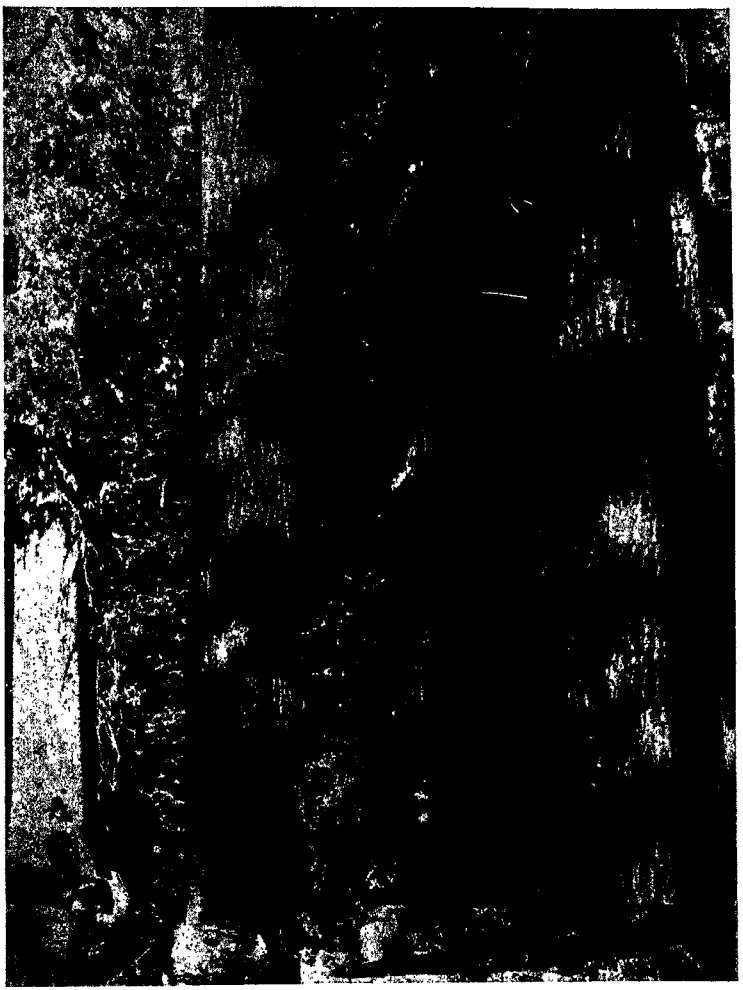


FIG. 30.—Some of the magnificent stands of Idaho white pine (*Pinus monticola*) found in northern Idaho and western Montana. Stands of 50,000 to 150,000 board feet per acre are frequently found. (Courtesy of the Weyerhaeuser Co.)

railways have facilities whereby cars can be lightered from the terminals direct to shipside or to various lighterage terminals throughout

the harbor. This is also true in some other harbors, while in others this lighterage charge of so much per ton or per thousand board feet is made.

ROUTING AND TRACING

Routing is an exceedingly important part of every shipment, because proper routing may save both time in reaching the destination and freight charges. If the shipper knows by what railroad delivery is to be made to the consignee he may direct the shipment accordingly and secure proper delivery without additional cost. The shipper always has the right to specify the route by which he wants shipment made, and carriers are made responsible for the routing as shown in the bill of lading.

When a carrier fails to make delivery in accordance with routing instructions it remains the duty of the carrier to effect delivery at the terminal designated in the original routing instructions. If any additional expense for switching or trucking is necessary, the additional expense must be borne by the carrier responsible for the misrouting.

In case the shipper has not given specific routing instructions or there are no through routes to destination, it becomes the duty of the carrier to forward the shipment by the cheapest reasonable route with the lowest combination of rates.

It is, of course, to the advantage of the carrier to keep the car on its line as long as possible, and many cars are routed in a roundabout way in order that the initial railroad may secure as large a share of the freight returns as possible.

When a car has been unduly delayed or has been lost, as sometimes happens, a tracer is sent out to locate it. Tracing is always initiated from the point where the car was last identified. Some lumber companies begin to trace the cars as soon as they are shipped, principally in times of transportation difficulties and embargoes.

Many wholesale dealers commonly trace all their shipments, to keep both shipper and customers advised of the location of every car. This is done principally in case of transit cars, so that the change in destination may be made without incurring unnecessary reconsignment charges. Some wholesalers have self-addressed post-cards sent to junction points, with the request to the carriers to keep them advised of the time each car in which they are interested is dispatched through certain junction points.

SWITCHING

Switching consists of moving cars from one siding or loading track to another and is distinguished from transportation, which consists of moving cars from one city or station to another. The switching of a car which is loaded at one place and is to be unloaded at another dock or wharf in the same city is known as terminal switching.

Switching is most commonly done at places where a belt line or terminal railroad serves a number of wharves, as for example at New Orleans and Mobile. Switching services are usually charged for at a certain rate per car such as $3. When a car is loaded on the tracks of one carrier and switched to those of another carrier, the latter usually issues a bill of lading and pays the former for its switch service.

Both the switching and transportation charges are collected from the shipper or the buyer by the carrier performing the service, unless the switching charge is absorbed in the transportation charge. If this is the case, the carrier usually makes no charges for switching cars to or from its own line, within the switching limits of the station.

In case two carriers are competing for traffic between two points, the switching charge of one is usually absorbed by the other in its transportation charge. This is of advantage to shippers located on the lines of both carriers, for it provides two routes at the same rates and the most satisfactory one can be chosen.

CARLOAD LOTS AND CAPACITIES

Hardwoods are usually shipped in the rough. Carloads vary from about 12,000 to 16,000 board feet for 4/4 stock. With rough green oak or hickory, 8000 to 10,000 board feet may constitute a minimum carload and come within the weight requirements. The average car of red gum, white oak, or other hardwoods contains from 12,000 to 14,000 board feet.

Softwoods vary considerably with the species. Carloads of rough yellow pine or Douglas fir usually run from 15,000 to 20,000 board feet. Dressed boards, flooring, ceiling, finish, roofers and similar stock may run from 18,000 to 36,000 board feet to the car, but the average carload is generally between 22,000 to 26,000 board feet, depending upon the finished sizes. Statistics of the Southern Pine Association show that the carloads of all kinds of rough and dressed stock contain, on an average, between 21,000 and 23,000.

It usually pays, through economy in freight rates, particularly on

long hauls, as from the Pacific Coast to the East or from Louisiana to Buffalo, to dress both shed and general yard stock. Even green timbers are dressed fresh from the head-saw, resulting in a great saving in freight. This partly accounts for the very heavy dressing practiced on the West Coast and objected to by a number of retailers and consumers in the East. Heavy dressing, in fact, is not usually done with stock in the green condition when used for structural purposes such as 2×4's, 2×6's, etc., up to timbers 6×6 inches and up. With flooring which is dressed commonly to $\frac{13}{16}\times 2\frac{1}{4}$ inches from 1×3 inches, the saving in size and the resultant increased car capacity is very evident.

With long lengths, such as those commonly shipped from the Pacific Coast, that is, over 40 feet, two flat cars are commonly employed, the long timbers resting on a swivel arrangement which takes care of curves. The freight rate is, of course, higher for double carloads.

Each railroad has its own specifications for minimum car weights for cars of each size. The minimum carload is generally 34,000 pounds for cars 36 feet and over in length, inside measurement, and 30,000 pounds for cars under 36 feet in length. In the Northwest, minimum car weights have been determined on the basis of cubic car capacity. Since the World War, 2400 cubic feet has been considered the minimum carload, representing 48,000 pounds. As the shippers regarded this as a distinct discrimination against the lighter lumber shipped from the Northwest, such as spruce, hemlock, and pine, when destined for eastern points, the case was brought up before the Interstate Commerce Commission, and after June, 1922, the minimum carload rates were as follows:

For cars 36 feet in length and shorter, 38,000 pounds; for cars over 36 feet in length and not over 42 feet, 44,000 pounds; and for cars over 42 feet in length, 54,000 pounds.

The rates for less than carload lots are, of course, prohibitive as far as moving lumber is concerned, and each railroad establishes rates which are in turn approved by the Interstate Commerce Commission for this purpose.

Cars have been loaded up to 35,000 to 40,000 feet or more, but this is exceedingly unusual. The general rule applied to shipments is that cars may be loaded to 10 per cent over the capacity as stated on the car. The maximum height on open cars is 13 feet.

According to the Interstate Commerce Commission regulations, the railroad may unload all weights over the maximum, at the shipper's expense.

EMBARGOES

Many terminal points and centers of freight activity are subject from time to time to great congestion of railroad movement. Such important export terminals as New York and New Orleans, for example, are often so crowded with cars that it is impossible to untangle the situation without preventing additional cars from coming in to increase the congestion. To assist in straightening out these difficulties, embargoes are promulgated on certain cities or districts and shipment of cars to those points is forbidden until the situation is back to normal or the congestion is sufficiently relieved to justify the withdrawal of the embargo.

Embargoes, as a rule, give priority to certain necessary commodities, particularly perishable freight. A priority list is established, and as conditions are improved the various commodities are allowed to come in, in the order in which they have been placed on such priority list. In all cases permits are issued when sufficient reason for their issuance is given.

Although exceedingly expensive to the common carriers themselves, embargoes are the only means by which railroads can relieve heavy freight congestion.

CAR SHORTAGE

In times of major movements of the grain crop, cotton, or coal, or whenever shipping activity is excessive, car shortages occur. The subject of car shortage is one of the most serious ones affecting the stability of the lumber business and the movement of cars from the mills to destinations.

If the movement of the 3,000,000 cars loaded annually with lumber were evenly distributed throughout the year, there would be little difficulty; but in the early spring and early fall, the movement of cars loaded with lumber is more active and it is exceedingly difficult at times to secure sufficient cars to keep pace with the orders. Both the railroads and the lumber companies advocate rapid loading and unloading of all cars and loading to capacity, in order to relieve the situation as far as possible.

During the six-year period from 1901 to 1907 inclusive, there were 1,500,000 cars ordered from the car-builders; whereas during the six-year period from 1915 to 1922 inclusive, less than 500,000 freight cars were ordered. These statistics explain, in a large measure, the car shortages of recent years.

Another reason why lumbermen have difficulty in moving their produce is that certain commodities, such as coal, grain, etc., are usually placed on priority lists, while lumber is not entitled to the same consideration.

The Interstate Commerce Commission has the right to order the distribution of cars, in times of embargo, without notice or hearing to the railroads to which the order may be directed.

During November, 1922, the car shortage situation was at the worst stage in the history of the country, the demand exceeding the supply by 160,000 cars. During a period of two weeks, statistics from 105 mills in six southern pine-producing states showed that only 30 per cent of the cars required by them were supplied.

Statistics or car loading show that for every 100 cars that are moving, either empty of loaded, 119 are being loaded, 119 are being unloaded, 164 are on repair tracks, and 680 are standing idle in yards.

It is estimated that, if the average load per car that prevailed during 1920 and 1921 had been secured in 1922, approximately 800,000 less cars would have been required to move our lumber and there would have been an available surplus of cars instead of a car shortage during the periods of congested movement.

The record loading of forest products during any week in the past shows 77,313 cars loaded during the week ended April 14, 1923.

MOTOR TRUCK VERSUS RAIL HAULS

With the increase in efficiency of transportation by motor trucks, the movement of lumber by this means has made rapid advances, particularly about centers of lumber consumption and large wholesale yards. Not only is motor truck transportation much more prompt, but it is also decidedly cheaper, up to hauls of 50 to 100 miles. It has been commonly used to haul lumber in the Metropolitan District around New York, in the Buffalo–Tonawanda district, and through the Chicago, Minneapolis, St. Louis, and Norfolk districts, both for retail and for wholesale distribution of lumber.

In periods of rail embargoes and freight congestion, the transportation of lumber by trucks assumes enormous proportions. For example, when one terminal point is embargoed, lumber is frequently shipped to a nearby point not under embargo and then moved to its destination by truck.

In many instances the question of delivery is even more important

than the price. Many buyers give orders with the understanding that the lumber is to be delivered by truck from the large distributing yard, rather than wait for rail movement directly from the mill.

CAR STAKES

The question of car stakes has long been a disputed one between lumber shippers and the common carriers. Numerous complaints have been filed with the Interstate Commerce Commission regarding various phases of the subject, but the present regulations specify that shippers are entitled to an allowance of 500 pounds weight for stakes. This is in accordance with a regulation issued on January 2, 1905.

Car stakes are only used in connection with flat and gondola cars. They are necessary to protect shipments en route to destination on such cars. The common carriers refuse to accept shipments of lumber loaded on flat or gondola cars unless they are properly protected or held in place by stakes, cross braces, etc.

The question of car stakes has also given rise to disputes between the buyer and the seller of lumber, the seller contending that the buyer should pay for lumber represented in the stakes and cross bracing, while the buyer has contended that they were not a part of his order and were not useful to him in any way. The common custom at the present time is not to bill the buyer for the lumber represented in the car stakes and bracing.

WATER TRAFFIC AND RATES

The use of barges for transporting lumber has been much more common in the past than at the present time. They are still frequently employed on the Mississippi and its tributary systems and along the Atlantic and Gulf Coast and to a limited extent on the Pacific Coast. They are in common use in distributing lumber in such large and important harbors as New York, New Orleans, Mobile, Chicago, Jacksonville, Seattle, Gray's Harbor, and Philadelipha, either from the mill to a vessel or by towing from the mill directly to destination, or conversely from the steamer or ocean-going vessel at the point of destination to the retailer's or contractor's yard or factory. Barges commonly contain from 100,000 to 500,000 board feet, but in exceptional cases they carry even larger amounts than this. They are commonly employed in the export trade for loading vessels with deep draughts.

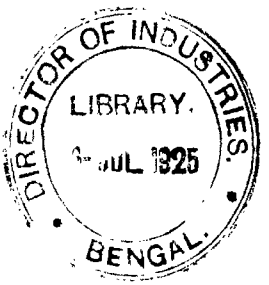
Since the World War, many wooden vessels constructed by the Government for war purposes have been converted into barges and used for the transportation of lumber between coastwise points, and also from the Gulf and Atlantic ports to Cuba, Porto Rico, the other West Indian Islands, and to Mexico.

The cost of barging, including receiving lumber from ships' tackles or delivering to them, and unloading on or loading from docks in our important harbors is usually from 50 cents to $2 per thousand board feet. It may be still more expensive, the exact cost depending upon distance, sizes and kind of lumber, number of hatches worked on vessel, and other loading or unloading facilities. Demurrage rates on large barges are generally high.

The charge for transportation via barges for longer distances depends upon the mileage, cost of towage, risks involved, and, above all, handling costs. Insurance is always used to cover barging. It is generally cheap, except in the well-known summer hurricane season on the Gulf, when rates advance sharply.

Schooners are commonly employed to transport lumber in coastwise traffic, especially along the Atlantic Coast and from the Gulf to North Atlantic ports. Their advantage lies in lower rates. However, few buyers are willing to purchase in schooner lots of 150,000 to 1,200,000 feet or more, and this method of transportation can only be used to advantage with buyers having waterfront yards. Schooners require a much longer time to reach destination than freight cars, and the costs of accumulation, storage, insurance and protection prior to shipment may be, at times, prohibitively large. Where mills are advantageously located on deep water and other conditions are favorable, they are profitably employed. Their use, however, has been on the decrease rather than the increase during the past ten years or more.

Steamers often offer rates which compete successfully with rail rates. On the Gulf and Atlantic Coasts there are liners operating a regular service, especially from Galveston, New Orleans, and Mobile, and from Jacksonville and Savannah to the North Atlantic cities. For lots of 300,000 feet or more these steamers will make a special port of call and deviate from their regular ports. On the Pacific Coast, steamers, both in regular and " tramp " service, are commonly used to transport lumber from Puget Sound, Columbia River, Gray's Harbor, Willapa Bay, and Coos Bay points to San Francisco, Oakland, San Pedro, San Diego, and other California points as well as to the Atlantic Seaboard.



CHAPTER X

CONSUMPTION

DOMESTIC AND EXPORT

A RELATIVELY small percentage of our annual lumber production is exported, the balance being consumed within this country. Census Bureau statistics show that only about 3 to 7 per cent of our lumber production has been exported in the past. The export trade showed a gradual tendency to increase both in volume and in value to the year 1914. A more complete discussion of the export trade is found in Chapter XII.

CONSUMING CENTERS

As stated in earlier chapters the consuming markets are generally far removed from the centers of lumber production, and the average car mile of lumber shipments is gradually being increased from year to year.

The centers of population, and consequently of lumber consumption, are, generally speaking, in the Northeast and Central West. The use of lumber in new construction, however, has been more active in southern California than in any other section of the country during the past decade. Lumber consumption is in almost direct proportion to population and increase of population.

As reported in Circular No. 115 of the United States Department of Agriculture which shows the total number of cars of lumber consumed annually by each state, the following are arranged in order of importance in lumber consumption: Illinois, California, Pennsylvania, New York, Missouri, Texas, Iowa, Minnesota, Washington, Kansas.

Investigations made during a period of five years prior to the World War, however, indicate that the following states, in order of consumption, are the most important: New York, Illinois, Pennsylvania, Michigan, Ohio and California, followed by the New England States as a section, Iowa, Missouri, etc.

An analysis of either of the above rankings indicates that the great volume of lumber consumption in this country follows directly the centers of population and percentages of growth of population combined with building activity.

Industrial utilization of lumber is assuming more and more importance in this country, and the great industrial states of New York, Pennsylvania, Illinois, Michigan, and Ohio will always be important consumers of lumber.

Changes in Lumber Markets.

A review of the lumber markets during the past fifty years will disclose a change in consumption as well as in lumber production, as described in the first two chapters of this book. For a long time consumption was largely restricted to the great cities along the Atlantic seaboard; but with the development and growth of the Central West, the mathematical center of population has shifted to a point in southern Indiana, and this has meant a gradual shifting in the great consuming markets.

The essential consideration and most important point is that lumber is being produced farther and farther away from its ultimate destination, and in many cases more money is paid out in the form of freights than for the F.O.B. value.

RATE OF CONSUMPTION

Per Capita.

The per capita consumption of lumber in this country is about 300 board feet annually. The per capita consumption of wood, as shown in a table in Chapter IV, is about 200 cubic feet per annum. This embraces all forms of forest products, including lumber.

Comparison with Forest Growth.

We are consuming our forests about four times as fast as they are growing, according to the report in response to Senate Resolution No. 311. It is very evident that, with this great disparity between growth and cutting, a critical period in our lumber and other forest industries will be reached, unless a sound and adequate forest policy is inaugurated to meet this situation.

Comparison with Europe.

Compared to our annual consumption of about 200 cubic feet per capita, the consumption in Germany is only 37 cubic feet, in France 25 cubic feet, and in Great Britain only 14 cubic feet.

It is evident from these figures that, with the cutting of the abundant and cheap virgin forests of this country and the necessity of growing a new supply, our per capita rate of consumption will gradually decrease in accordance with the economic laws of supply and demand.

PRINCIPAL AND SECONDARY USES OF EACH SPECIES

The following tables[1] show the amount of each important kind of lumber produced in the rough for a given year and the amount remanufactured or used in the manufacture of various wooden products. These tables do not take into consideration forest products other than lumber used for these various purposes. They are based upon studies made during a five-year period prior to the World War, and represent an average year.

Figures for production are taken for a more recent year, and consequently, in the case of some species, the figures for production and consumption do not agree.

For each species there are given the chief characteristic qualities, the general uses as a result of these qualities, and the specific uses of the lumber that is remanufactured or used otherwise than in the rough condition. Both softwoods and hardwoods are classified according to use, as general purpose and special purpose woods.

[1] Those devoted to amounts of lumber remanufactured are taken from U. S. Dept. Agr. Bull. 605, "Lumber Used in the Manufacture of Wooden Products," by J. C. Nellis, 1918.

General Purpose Softwoods.

Southern yellow pine, including longleaf pine (*Pinus palustris*), shortleaf (*P. echinata*), loblolly (*P. taeda*), and Cuban pine (*P. heterophylla*).

Characteristic Qualities. The wood of the southern yellow pines varies considerably. Longleaf pine is compact, hard, heavy, resinous, fairly even-grained, and strong. Shortleaf pine is generally not so strong, heavy or hard. Arkansas shortleaf is especially soft, even-grained and workable. Loblolly is the poorest of the southern yellow pines.

General Uses. Heavy construction work, shipbuilding, cross ties, crating, and planing mill products.

Production. Rough lumber and timber (1919) 13,062,938 M feet BM, representing 37.8 per cent of the total production of all species (1919).

Amount remanufactured, in all industries, 8,610,685,624 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	6,447,780,805	74.8
Boxes and crates	1,044,993,123	12.1
Car construction	678,114,162	7.8
Agricultural implements	98,453,396	1.1
Ship and boat building	65,698,652	0.8
Paving material and conduits	65,092,000	0.8
Tanks and silos	41,291,700	0.5
Vehicles and vehicle parts	31,205,478	0.4
Machine construction	22,461,088	0.3
Total	8,495,090,404	98.6
Other miscellaneous uses (includes moldings, elevators, laundry equipment, musical instruments and patterns)	115,595,220	1.4
Grand total	8,610,685,624	100.0

Douglas fir (*Pseudotsuga taxifolia*).

Characteristic Qualities. The wood is strong, compact, tough, straight-grained, resilient, holds nails well and is durable. It is used interchangeably with southern pines.

General Uses. Heavy construction work where large timbers are desired, planing mill products, shipbuilding, car construction, flooring, cross ties, tanks and silos.

Production. Rough lumber and timber (1919): 5,902,169 M feet BM, representing 17.1 per cent of total production of all species (1919).

Amount Remanufactured, in all industries: 2,273,788,484 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	1,991,177,352	87.8
Tanks and silos	89,705,322	4.0
Car construction	86,544,784	4.0
Ship and boat building	44,342,081	1.9
Pumps and wood pipe	21,351,480	0.9
Furniture	11,387,790	0.5
Boxes and crates	7,349,840	0.3
Fixtures	5,512,000	0.2
Paving materials and conduits	3,500,000	0.1
Total	2,261,870,649	99.7
Other miscellaneous uses (including shade and map rollers, woodenware, agricultural implements, machine construction, vehicle construction and fencing)	11,917,835	0.3
Grand total	2,273,788,484	100.0

Western soft pine (*Pinus ponderosa*).

Characteristic Qualities. The wood is light, soft, slightly resinous, easily worked, and holds nails well, not especially durable. Used in place of eastern white pine for many purposes.

General Uses. Planing mill products and millwork, crating and fixtures.

Production. Rough lumber and timber (1919): 1,775,015 M feet BM, representing 5.1 per cent of total production of all species (1919).

Amount Remanufactured, in all industries: 563,816,810 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Boxes and crates	288,291,927	51.2
Planing mill products and general millwork	264,920,778	47.1
Car construction	4,242,500	0.8
Furniture	1,806,985	0.3
Signs and supplies	1,000,000	0.2
Fixtures	961,720	0.2
Caskets and coffins	543,500	0.09
Ship and boat building	518,500	0.08
Total	562,285,910	99.97
Other miscellaneous uses (includes woodenware, trunks and patterns)	1,520,900	0.03
Grand total	563,816,810	100.00

Spruce (all species).

Characteristic Qualities. The wood of spruce is long-fibered, non-resinous, light, soft, elastic, and resonant.

General Uses. Building material, crating, paper-pulp and musical instruments.

Production. Rough lumber and timber (1919), 979,968 M feet BM, representing 2.8 per cent of total production of all species (1919).

Amount Remanufactured, in all industries, 805,050,195 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	350,528,295	43.7
Boxes and crates	335,935,643	41.7
Musical instruments	29,144,150	3.7
Woodenware and novelties	28,591,148	3.6
Tanks and silos	10,233,500	1.2
Car construction	8,799,060	1.1
Ship and boat building	7,783,980	1.0
Refrigerators and kitchen cabinets	5,555,690	0.7
Total	776,571,376	96.7
Other miscellaneous uses (includes furniture, woodenware, fixtures, fencing, airplanes)	28,478,819	3.3
Grand total	805,050,195	100.0

White pine, including eastern white pine (*Pinus strobus*), western (Idaho) white pine (*P. monticola*), Norway pine (*P. resinosa*), and jack pine (*P. divaricata*).

Characteristic Qualities. The wood is soft, light, of uniform texture, seasons well, is easy to work, and takes nails without splitting.

General Uses. Planing mill products and millwork, patterns and boxes.

Production. Rough lumber and timber (1919), 1,723,642 M feet BM, representing 5 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 3,112,698,017 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	1,543,345,756	49.6
Boxes and crates	1,131,969,940	36.3
Car construction	75,382,166	2.3
Matches and toothpicks	73,059,611	2.2
Shade and map rollers	61,450,000	1.9
Woodenware and novelties	47,744,797	1.4
Caskets and coffins	33,170,942	1.0
Patterns and flasks	17,854,635	0.5
Tanks and silos	17,007,600	0.4
Ship and boat building	14,256,006	0.3
Total	3,015,541,453	95.9
Other miscellaneous uses (includes furniture, musical instruments, fixtures, agricultural implements, molding, signs and laundry appliances)	158,906,564	4.1
Grand total	3,112,698,017	100.0

Hemlock, including eastern hemlock (*Tsuga canadensis*), and western hemlock (*T. heterophylla*).

Characteristic Qualities. The wood is light, weak, coarse and splintery, grain often crooked. The western species has straighter grain, is stronger, harder, and much better than the eastern species for general purposes.

General Uses. Rough construction work, planing mill products, and crating.

Production. Rough lumber and timber (1919), 1,754,998 M feet BM, representing 5.1 per cent of total production of all species (1919).

Amount Remanufactured, in all industries, 708,752,769 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	442,050,165	62.6
Boxes and crates	203,526,091	28.7
Car construction	12,455,379	11.7
Furniture	7,053,446	1.0
Trunks and valises	7,000,000	1.0
Refrigerators and kitchen cabinets	6,934,872	1.0
Gates and fencing	5,152,000	0.8
Ship and boat building	4,745,775	0.7
Total	688,917,728	97.5
Other miscellaneous uses (includes woodenware, agricultural implements, caskets and coffins, machine construction, mine equipment and elevators)	19,835,041	2 5
Grand total	708,752,769	100.0

Sugar pine (*Pinus lambertiana*).

Characteristic Qualities. The wood is soft, light, white to pale brown in color, easily worked, resembling very closely the wood of eastern white pine.

General Uses. Planing mill products, crating and boxes.

Production. Rough lumber and timber (1919), 133,658 M feet BM, representing 0.4 per cent of total production of all species.

Amount Remanufactured, in all industries, 59,211,298 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	31,795,077	53.8
Boxes and crates	24,686,000	41.8
Musical instruments	1,004,400	1.7
Woodenware and novelties	419,063	0.7
Furniture	375,510	0.6
Patterns and flasks	294,350	0.5
Fixtures	206,650	0.3
Total	58,781,050	99.4
Other miscellaneous uses (includes boat building, shade and map rollers, matches and cigar boxes)	430,248	0.6
Grand total	59,211,298	100.0

Larch, including eastern larch (*Larix laricina*), and western larch (*L. occidentalis*).

Characteristic Qualities. The wood is heavy, coarse-grained, very strong and durable. The western species, cut in Montana and Idaho, is the more important and better wood.

General Uses. Ties, posts, rough construction work, and for purposes where resistance to moisture is an asset.

Production. Rough lumber and timber (1919), 388,121 M feet BM, representing 1.1 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 114,029,275 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	88,484,081	77.5
Tanks and silos	9,745,000	8.5
Boxes and crates	7,470,300	6.5
Paving material and conduits	4,475,000	3.9
Car construction	1,537,669	1.4
Electrical machinery, etc	700,000	0.6
Total	111,412,050	98.4
Other miscellaneous uses (includes woodenware, boat building, pumps and wood pipe)	2,612,225	1.6
Grand total	114,020,275	100.0

Special Purpose Softwoods.

Redwood (*Sequoia sempervirens*).

Characteristic Qualities. Redwood is soft, fine-grained, red or purplish in color, easily worked and very durable. Because large clear boards can be cut from the big trees, this wood finds many special uses.

General Uses. Planing mill products, caskets, tanks and silos, and wood pipe.

Production. Rough lumber and timber (1919), 410,442 M feet BM, representing 1.2 per cent of total production of all species (1919).

Amount Remanufactured, in all industries, 122,326,779 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	92,759,519	75.8
Pumps and wood pipe	9,117,500	7.5
Tanks and silos	8,124,938	6.6
Woodenware and novelties	3,208,150	2.6
Boxes and crates	2,439,500	2.0
Caskets and coffins	1,782,000	1.5
Fixtures	1,074,710	0.9
Patterns and flasks	1,033,200	0.8
Ship and boat building	837,500	0.7
Total	120,377,017	98.4
Other miscellaneous uses (includes furniture, refrigerators and woodenware)	1,949,762	1.6
Grand total	122,326,779	100.0

Cedar, including western red cedar (*Thuya plicata*), northern white cedar (*T. occidentalis*), southern white cedar (*Chamaecyparis thyoides*), Port Orford cedar (*C. lawsoniana*), and incense cedar (*Libocedrus decurrens*).

Characteristic Qualities. The wood of the cedars is generally soft, light, and weak, but it has a straight, even grain. A distinct odor or color is characteristic of some species. Cedar is very durable.

General Uses. Shingles, fence posts, poles, planing-mill products, boats and furniture.

Production. Rough lumber and timber (1919), 332,234 M feet BM, representing 1 per cent of total production of all species (1919).

Amount Remanufactured, in all industries, 102,248,253 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	45,187,611	44.1
Professional and scientific instruments	20,050,000	19.6
Ship and boat building	6,999,722	6.8
Woodenware and novelties	6,405,470	6.2
Caskets and coffins	5,901,718	5.7
Laundry appliances	4,867,000	4.6
Tanks and silos	4,549,000	4.3
Boxes and crates	2,512,150	2.5
Furniture	1,856,100	1.8
Total	97,428,771	95.6
Other miscellaneous uses (includes chairs, fixtures, matches and toothpicks, gates and fencing, machinery and apparatus)	4,819,482	4.4
Grand total	102,248,253	100.0

Cypress (*Taxodium distichum*).

Characteristic Qualities. The wood is soft, light but strong, straight-grained, easily worked, and very durable.

General Uses. General construction work, especially where a moisture-resistant wood is desired, interior finish, tanks and silos and crating.

Production. Rough lumber and timber (1919), 656,212 M feet BM, representing 1.9 per cent of total production of all species (1919).

Amount Remanufactured, in all industries, 668,353,342 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	508,728,575	76.2
Boxes and crates	38,962,895	5.7
Tanks and silos	35,408,575	5.3
Caskets and coffins	19,157,633	2.9
Machine construction	15,868,405	2.4
Laundry appliances	15,321,300	2.3
Total	633,447,383	94.8
Other miscellaneous uses (includes woodenware, ship and boat building, fixtures, furniture, pumps and wood pipe, trunks and valises)	34,905,959	5.2
Grand total	668,353,342	100.0

General Purpose Hardwoods.

Oak (all species).

Characteristic Qualities. The wood of the oaks is generally very heavy, hard, and has a pleasing grain, especially on the radial surface. The so-called "white oaks" are usually considered more durable and superior to the so-called "red oaks." Oak will take a high polish.

General Uses. Furniture, veneers, fixtures, interior decoration, cooperage and car construction. Oak is the principal cross-tie and cooperage wood.

Production. Rough lumber and timber (1919), 2,708,280 M feet BM, representing 7.8 per cent of total production of all species (1919).

Amount Remanufactured, in all industries, 1,983,584,491 feet BM.

	Feet BM.	Per Cent of Total
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	501,367,772	25.1
Furniture	431,053,289	21.8
Car construction	305,276,814	15.8
Vehicles and parts	212,918,361	10.7
Chairs and chair stock	135,269,118	6.8
Agricultural implements	69,346,130	3.5
Fixtures	62,681,744	3.2
Boxes and crates	56,362,111	2 8
Ship and boat building	32,382,311	1.6
Refrigerators and kitchen cabinets	31,351,521	1.5
Musical instruments	20,638,480	1.1
Sewing machines	19,106,250	1.0
Total	1,877,753,901	94.9
Other miscellaneous uses (includes woodenware, handles, machine construction, boot and shoe findings, plumber's woodwork, machinery and mine equipment)	105,830,590	5.1
Grand total	1,983,584,491	100.0

Maple (all species).

Characteristic Qualities. The wood of the hard maple is very hard, tough, usually straight-grained, heavy and strong, but not durable. It wears evenly and will take a high polish.

General Uses. Furniture, flooring and millwork, ship-building, crating, shoe lasts, and musical instruments.

Production. Rough lumber and timber (1919), 857,489 M feet BM, representing 2.5 per cent of total production of all species (1919).

Amount Remanufactured, in all industries, 919,420,274 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	317,634,231	34.5
Boxes and crates	96,831,648	10.5
Furniture	87,571,456	9.4
Boot and shoe findings	54,050,000	5.8
Agricultural implements	48,319,210	5.2
Chairs and chair stock	47,264,747	5.1
Musical instruments	45,482,775	5.0
Handles	41,238,446	4.4
Woodenware and novelties	38,255,880	4.1
Vehicles and parts	35,863,267	3.8
Fixtures	20,701,026	2.2
Laundry appliances	14,219,000	1.4
Shuttles, spools and bobbins	13,531,450	1.3
Total	850,963,136	92.7
Other miscellaneous uses (includes sporting goods, kitchen cabinets, toys, trunks, butchers blocks, brushes, and carpet sweepers)	68,457,138	7.3
Grand total	919,420,274	100.0

Red gum (*Liquidambar styraciflua*).

Characteristic Qualities. The wood is fairly heavy, close-grained and workable. Its color, grain, and ability to take a high polish make it desirable for many purposes.

General Uses. Cabinet work, furniture, vehicles, crating and planing-mill products. Red gum is the principal wood used for veneers and slack cooperage.

Production. Rough lumber and timber (1919), 851,431 M feet, BM, representing 2.5 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 797,343,658 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Boxes and crates	402,121,640	50.5
Planing mill products and general millwork	121,366,583	15.2
Furniture	102,237,867	12.7
Vehicles and parts	26,650,314	3.3
Sewing machines	20,774,280	2.6
Pulleys and conveyors	19,677,500	2.5
Refrigerators and kitchen cabinets	13,483,400	1.7
Agricultural implements	11,976,000	1.5
Musical instruments	9,243,825	1.2
Chairs and chair stock	8,790,280	1.1
Woodenware and novelties	8,358,296	1.0
Picture frames and molding	7,675,040	1.0
Caskets and coffins	7,010,520	0.9
Tobacco boxes	6,898,270	0.8
Handles	6,654,300	0.8
Fixtures	5,491,170	0.7
Total	777,409,285	97.5
Other miscellaneous uses (includes tanks and silos, laundry appliances, paving material, saddles)	19,934,373	2.5
Grand total	797,343,658	100.0

Yellow poplar (*Liriodendron tulipifera*).

Characteristic Qualities. The wood of yellow poplar is soft, light, easily worked, holds nails well, and can be secured in large, wide pieces. It is often called " white wood," although its colors varies from white to yellowish green.

General Uses. Planing mill products, crating, furniture, veneers, and musical instruments.

Production. Rough lumber and timber (1919), 328,538 M feet BM, representing 0.9 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 680,936,848 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	236,047,697	34.7
Boxes and crates	165,416,737	24.3
Furniture	53,374,580	7.8
Vehicles and parts	48,665,960	7.2
Musical instruments	40,371,925	5.8
Car construction	32,439,064	4.8
Bungs and faucets	18,010,000	2.7
Fixtures	14,574,881	2.1
Agricultural implements	12,412,300	1.8
Caskets and coffins	9,640,860	1.4
Sewing machines	8,039,244	1.2
Tobacco boxes	7,358,919	1.1
Total	646,352,107	94.9
Other miscellaneous uses (includes refrigerators, laundry appliances, molding, trunks, pumps and wood pipe)	34,584,681	5.1
Grand total	680,936,848	100.0

Birch, including yellow birch (*Betula lutea*), paper birch (*B. papyrifera*), gray birch (*B. populifolia*), sweet birch (*B. lenta*), and river birch (*B. nigra*). Almost entirely yellow birch.

Characteristic Qualities. The wood of birch is close-grained, heavy, hard, very strong, often of a pleasing color, and will take a high polish. It is often used in imitation of mahogany.

General Uses. Planing mill products, furniture, flooring, doors, crating, shuttles and bobbins, shoe lasts and novelties.

Production. Rough lumber and timber (1919), 375,079 M feet BM, representing 1.1 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 481,293,680 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	133,867,989	26.9
Boxes and crates	90,787,900	18.9
Furniture	54,677,450	11.6
Shuttles, spools and bobbins	33,192,000	7.2
Chairs and chair stock	30,114,332	6.3
Woodenware and novelties	29,547,890	6.1
Fixtures	15,255,129	3.2
Vehicles and vehicle parts	14,227,125	3.0
Musical instruments	12,349,055	2.6
Handles	9,908,250	2.2
Dowels	8,149,000	1.8
Boot and shoe findings	7,483,000	1.6
Car construction	5,830,429	1.3
Total	446,389,549	92.7
Other miscellaneous uses (includes agricultural implements, picture frames, toys, brushes, weighing apparatus)	34,904,131	7.3
Grand total	481,293,680	100.0

Chestnut (*Castanea dentata*).

Characteristic Qualities. The wood is rather soft, light, easily split and not very strong. It is difficult to season properly, takes a high polish and is sometimes substituted for oak in furniture.

General Uses. Planing mill products, crating, furniture, caskets, building material and fixtures.

Production. Rough lumber and timber (1919), 545,696 M feet BM, representing 1.6 per cent of total production of all species (1919).

Amount Remanufactured, in all industries, 298,849,801 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Planing mill products and general millwork	82,267,497	27.6
Caskets and coffins	46,586,629	15.5
Furniture	44,734,180	15.0
Musical instruments	38,125,141	12.7
Boxes and crates	36,216,700	12.2
Woodenware and novelties	20,853,100	7.0
Fixtures	8,039,595	2.7
Chairs and chair stock	5,240,630	1.8
Gates and fencing	5,121,500	1.6
Total	287,184,972	96.1
Other miscellaneous uses (includes car construction, ship-building, trunks, sporting goods, mine equipment, and vehicles)	11,664,829	3.9
Grand total	298,849,801	100.0

Beech (*Fagus atropunicea*).

Characteristic Qualities. The wood is very hard, heavy, not easily worked, apt to check in seasoning, not very durable.

General Uses. Planing mill products, handles, furniture, novelties, and crating.

Production. Rough lumber and timber (1919), 358,985 M feet BM, representing 1.0 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 278,203,632 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Boxes and crates	77,899,280	28 0
Planing mill products and general millwork	58,394,284	21.0
Chairs and chair stock	27,187,621	9.8
Furniture	21,163,204	7.6
Handles	16,691,207	6.0
Woodenware and novelties	14,101,553	5.1
Laundry appliances	9,580,000	3.4
Brushes	6,378,894	2.3
Vehicles and vehicle parts	5,497,743	2.0
Agricultural implements	4,968,490	1.8
Musical instruments	4,186,000	1.5
Total	246,043,276	88.5
Other miscellaneous uses (includes shuttles and bobbins, toys, playground equipment, canes and umbrella sticks)	32,160,356	11.5
Grand total	278,203,632	100.0

Elm, including white elm (Ulmus americana), red elm (*U. pubescens*), and rock elm (*U. racemosa*).

Characteristic Qualities. The wood is moderately heavy, tough, with fibers often twisted or interlaced, making it difficult to split. It has great elasticity.

General Uses. Cooperage, automobile bodies, crating, furniture, and handles.

Production. Rough lumber and timber (1919), 194,417 M feet BM, representing 0.6 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 218,200,988 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Boxes and crates	63,726,458	29.2
Vehicles and vehicle parts	31,296,922	14.3
Chairs and chair stock	23,157,586	10.6
Woodenware and novelties	16,383,426	7.5
Musical instruments	15,602,440	7.1
Refrigerators and kitchen cabinets	13,046,100	6.0
Furniture	12,154,102	5.6
Total	175,367,034	80.3
Other miscellaneous uses (includes agricultural implements, handles, fixtures, trunks and valises, and sporting goods)	42,833,954	19.7
Grand total	218,200,988	100.0

Special Purpose Hardwoods.

Ash, including white ash (*Fraxinus americana*), green ash (*F. lanceolata*), black ash (*F. nigra*), red ash (*F. pennsylvanica*), Oregon ash (*F. oregona*).

Characteristic Qualities. The wood is hard, heavy, elastic and strong, holds its shape well, but is not especially durable.

General Uses. Woodenware and dairymen's supplies, handles, sporting goods and furniture.

Production. Rough lumber and timber (1919), 154,931 M feet BM, representing 0.4 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 295,461,482 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Handles	64,156,872	21.8
Woodenware and dairymen's supplies	62,635,800	21.1
Vehicles and vehicle parts	43,974,668	14.8
Planing mill products and general millwork	21,304,374	7.3
Refrigerators, kitchen cabinets	19,066,380	6.5
Car construction	18,163,433	6.2
Furniture	15,668,588	5.3
Agricultural implements	10,677,400	3.6
Boxes and crates	10,507,308	3.5
Ship and boat building	7,985,554	2.7
Sporting and athletic goods	3,180,000	1.8
Total	278,310,377	94.6
Other miscellaneous uses (includes chairs, musical instruments, machine construction, saddles, pumps and wood pipe)	17,151,105	5.4
Grand total	295,461,482	100.0

Hickory including shagbark hickory (*Hicoria ovata*), shellbark (*H. laciniosa*), pignut (*H. glabra*), bitternut (*H. minima*), and mockernut (*H. alba*).

Characteristic Qualities. The wood is exceedingly hard, heavy, strong, flexible and tough, but not durable.

General Uses. Wherever its toughness and elastic properties are valuable, vehicles, sporting goods, implements and handles.

Production. Rough lumber and timber (1919), 170,013 M feet BM, representing 0.5 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 389,604,531 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Vehicles and vehicle parts	239,491,910	61.5
Handles	120,294,466	31.0
Agricultural implements	9,860,470	2.5
Sporting goods	4,944,000	1.3
Planing mill products and general millwork	2,489,288	0.6
Woodenware and novelties	1,567,011	0.4
Butchers' blocks and skewers	1,310,000	0.3
Chairs and chair stock	1,192,200	0.3
Total	381,149,345	97.9
Other miscellaneous uses (includes machine construction, crating, shuttles, bobbins, pumps and woodpipe, and scientific instruments)	8,455,186	2.1
Grand total	389,604,531	100.00

Basswood (*Tilia americana*).

Characteristic Qualities. The wood is straight-grained, relatively very light, soft, easy to work, but not strong or durable.

General Uses. Crating, novelties, trunks, furniture and moldings.

Production. Rough lumber and timber (1919), 183,562 M feet BM, representing 0.5 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 369,640,782 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Boxes and crates	86,979,611	23.5
Planing mill products and general millwork	60,557,122	16.4
Woodenware and novelties	58,563,923	16.0
Furniture	33,146,276	9.0
Trunks and valises	21,164,406	5.7
Picture frames and moldings	20,340,700	5.5
Musical instruments	10,968,180	3.0
Toys	8,739,242	2.4
Agricultural implements	7,861,750	2.1
Fixtures	7,114,755	1.9
Vehicles and vehicle parts	6,418,308	1.7
Total	321,854,273	87.2
Other miscellaneous uses (includes handles, car construction, refrigerators, matches, toothpicks, clocks and tobacco boxes)	47,786,509	12.8
Grand total	369,640,782	100.00

Tupelo, including tupelo or cotton gum (*Nyassa aquatica*), black gum (*N. sylvatica*), and water gum (*N. biflora*).

Characteristic Qualities. The wood is rather variable in color, from white to brown, fairly hard and heavy, difficult to split because of its thickly interlocked fibers. It shows severe checking and warping unless properly seasoned.

General Uses. Crating, millwork, tobacco boxes and paving material.

Production. Rough lumber and timber (1919), 143,730 M feet BM, representing 0.4 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 127,958,309 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Boxes and crates	74,982,910	58.1
Planing mill products and general millwork	17,003,448	13.3
Tobacco boxes	10,376,217	8.1
Woodenware and novelties	5,366,900	4.2
Laundry appliances	3,842,000	3.0
Mine equipment	3,589,760	2.8
Furniture	2,529,000	2.0
Sewing machines	2,200,000	1.7
Total	119,890,235	93.2
Other miscellaneous uses (includes agricultural implements, musical instruments, paving materials, pulleys and conveyors)	8,068,074	6.8
Grand total	127,958,309	100.0

Cottonwood, including common cottonwood (*Populus deltoides*), swamp cottonwood (*P. heterophylla*), aspen (*P. tremuloides* and *P. grandidentata*) Balm of Gilead (*P. balsamifera*), and black cottonwood (*P. trichocarpa*).

Characteristic Qualities. The wood is soft, workable, light and weak, and not durable.

General Uses. Crating, planing mill products, vehicles and woodenware.

Production. Rough lumber and timber (1919), 144,155 M feet BM, representing 0.4 per cent of the total production of all species (1919).

Amount Remanufactured, in all industries, 322,642,796 feet BM.

	Feet BM.	Per Cent of Total.
Specific Uses of Remanufactured Lumber:		
Boxes and crates	210,519,509	65.5
Vehicles and vehicle parts	33,278,658	10.3
Planing mill products and general millwork	21,428,700	6.7
Agricultural implements	15,143,000	4.7
Woodenware and novelties	13,315,396	4.1
Laundry appliances	7,991,500	2.5
Furniture	5,158,309	1.6
Total	306,835,072	95.4
Other miscellaneous uses (includes car construction, handles, caskets, coffins, musical instruments and trunks)	15,807,724	4.6
Grand total	322,642,796	100.0

PRINCIPAL LUMBER-CONSUMING INDUSTRIES

About 60 per cent of the rough lumber manufactured in American sawmills is remanufactured in industries or dressed before being used. The balance, or 40 per cent of all of our lumber and timber, is used in the rough condition, that is, as it comes from the head-saw.

Studies made of lumber consumption in all the states over a period of about five years showed that about 24,500,000,000 board feet are annually used in our industries. The following table shows the principal industries which remanufacture lumber, together with the annual amount consumed:

PRINCIPAL INDUSTRIES AND PRODUCTS

	Million Feet BM.
Planing mill products—general millwork, sash, doors, blinds	13,429
Boxes and crates	4,550
Car construction	1,262
Furniture	945
Vehicles and vehicle parts	739
Woodenware, novelties, dairymen's, poulterer's, and apiarists' supplies	405
Agricultural implements	321
Chairs and chair stock	290
Handles	280
Muscial instruments	260
Tanks and silos	226
Ship and boat building	200
Miscellaneous	1,593

Softwoods for Structural Purpóses.

It will be noted from the foregoing tables and statistics that softwoods are peculiarly well fitted for general construction purposes because of their advantageous physical properties and the fact that they have been relatively abundant and inexpensive. It is indeed fortunate that our forests contain about 80 per cent of softwoods, as these have been the most useful all-around species for the growth and development of the country.

Hardwoods for Specialized Purposes.

Our virgin forests contain an excellent variety of hardwoods, the technical properties of which fit them peculiarly well for specialized purposes, such as flooring, furniture, cabinet work, etc., quite distinct from general structural purposes. The proportion of hardwoods found

in our native forests fits in very agreeably with the requirements of our industries. Contrasted with these conditions are those of the tropics, where the forests are largely made up of heavy, hard, durable hardwoods, and where large quantities of softwoods must be imported for construction purposes.

UTILIZATION OF ASSOCIATED PRODUCTS[1]

Intimately associated with lumber production and consumption are the production and consumption of many other important forest products. The statistics of these associated products are shown in the table in Chapter IV. In the northwestern sawmills, cross ties are an important by-product; elsewhere, they are usually hewn by hand on comparatively small operations.

The production and use of box boards, called shooks, is an important industry by itself. Approximately 15,000,000,000 board feet of lumber are used annually for the manufacture of boxes and crating.

In sections of Wisconsin, Michigan, northern Idaho, and Eastern Virginia, the production of cedar poles and posts constitutes an important forest industry. They are commonly sold in connection with the lumber produced on the same operations.

Closely associated with the lumber industry in many important sawmill operations, in California, Washington, Wisconsin, and the South, are veneer mills operated to produce material for making doors, sash, panels, berry baskets, chair seats, drawer bottoms, etc.

The manufacture of both tight and slack cooperage is carried on in connection with the production of hardwoods, particularly in sections such as Arkansas, Kentucky, and Mississippi.

The installation of large pulp and paper plants, to use material otherwise wasted, both on woods operations and at the sawmills, has been an important recent development in the lumber industry. Several hundred thousand cords of slabs, edgings, trimmings, and other material formerly burned at sawmills, or tops, limbwood, etc., left to rot in the woods, are now being sent to pulp and paper plants, notably at Moss Point, Miss. and Bogalusa, La., and to various plants in Wisconsin, New York, and Maine.

The installation of wood distillation plants has received considerable attention as a means of utilizing woods waste at both hardwood and

[1] For complete details of this subject, see Forest Products, Their Manufacture and Use, by Nelson C. Brown, John Wiley & Sons, Inc., New York City.

softwood operations. In connection with several hardwood mills in Michigan, important distillation plants are now in operation. New processes are constantly being developed to extract the resin from longleaf and other southern pines, and the ultimate results of these developments are likely to be of vast importance to the lumber industry both in the South and in the West.

In nearly every large southern pine operation, the longleaf and Cuban pines are tapped for naval stores. The production of turpentine and rosin is a very important industry and is carried on by most of the important lumber companies in the south, particularly in Florida, Louisiana and Mississippi.

In Washington and Oregon, the production of shingles, either in separate operations or in connection with sawmills, occupies an important position. Approximately 80 to 90 per cent of all of the shingles used in this country are produced in the western red cedar of the Northwest.

CHAPTER XI

PRESERVATION

HISTORICAL REVIEW

FROM the earliest times, various means have been employed to lengthen the life of wood in service. In very early days, wood was charred or painted to prevent decay under exposure.

The preservative treatment of timbers has been actively practiced in Europe for more than one hundred years, and at the present time practically all the cross ties, telephone and telegraph poles, and other material exposed to decay are subjected to some form of preservative treatment in all of the Western European countries.

In this country wood preservation has made rapid strides since 1900. The real foundation of the industry was laid in 1873, with the installation of a plant at Pascagoula, Miss., on the Louisville and Nashville Railway. In 1904 there were 33 plants in operation in the United States, with a capacity of 250,000,000 board feet of treated material. The railroads are naturally the greatest users of timber and wooden materials to be affected by this industry, and at the present time all of our great American railway systems have one or more timber-treating plants, either owned by the railroads or operated in connection with them, largely for the treatment of cross ties.

MATERIALS TREATED

The principal materials treated are:

1. Cross ties (about 40 per cent of the total annual consumption of 100,000,000 ties is subjected to treatment).
2. Poles, round piling and sheet piling.
3. Paving blocks.
4. Posts.
5. Cross arms.
6. Shingles.
7. Timbers used for bridges, mines, jetties, wharves, mill construction and all forms of outside construction.

REASONS FOR PRESERVATIVE TREATMENT

The principal and most convincing argument for the preservative treatment of timbers is economy. If timbers in their native condition will last only three to ten years, and by preservative treatment they can be made to last twenty-four years or more, the saving in cost, taking into account the actual cost of treatment plus interest, can be readily adduced to show the saving effected by preservative treatment.

Aside from the general principle of great saving, the following will further explain the reasons for preservative treatment.

1. Decay is responsible for approximately 90 per cent of all timber and wood replacements. It is estimated that 8 billion board feet of lumber and timber are annually destroyed by decay. All wood is susceptible to decay, which is caused by active living organisms called fungi. Fungi require a certain degree of moisture, warm temperatures and oxygen, for their existence. If any or all of these conditions are removed, wood will practically last forever. For example, piling driven by Caesar for bridges across the Rhine about two thousand years ago has been removed and found to be in a sound condition. Piling driven below the surface of the water will practically last forever unless susceptible to abrasion.

2. The supply of durable woods is decreasing and, as a result, the price of cross ties and other materials is increasing. In the early days of this country, durable woods, such as white oak, longleaf yellow pine, locust, and chestnut, were relatively abundant, accessible and inexpensive. All these woods have risen in value, and it has now become an economy to use relative cheap perishable woods and, by preservative treatment, increase their life from one to three times the period of service given in their untreated condition.

3. There has been an increase in the transportation charges for bringing timbers and cross ties long distances to their place of service. Since our more accessible forests have been cut it is now necessary to transport timbers considerable distances, and the general tendency is to use local woods wherever available and employ preservative treatment to make their durability equal to that of the woods which are not so readily available. During the war, the Government practically forced the railroads to use the woods growing along their rights of way, owing to the difficulties in filling the transportation requirements of the country during and immediately following the war period.

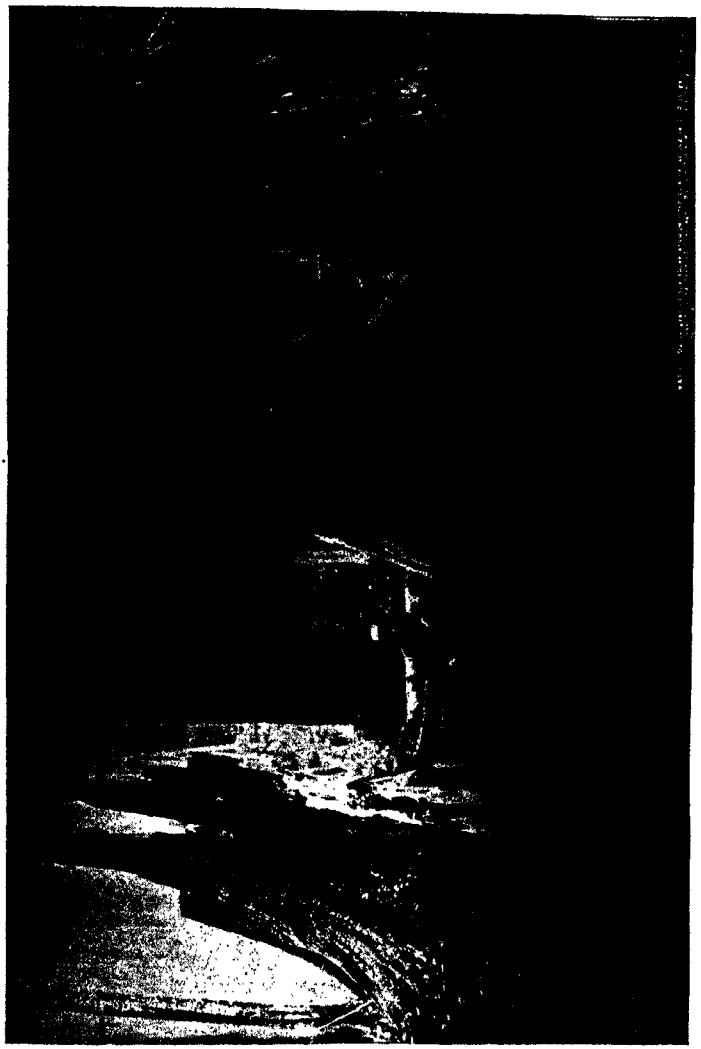


FIG. 31.—A good example of the durability of wood. The largest stump over the fallen red cedar log has 1380 annual rings. Shingle bolts cut from the prostrate tree were perfectly sound. Photograph taken in Western Washington.

4. The replacement charges are heavy. It is estimated that it costs from $1 to $2 to remove a rotted cross tie and replace it with a sound one. This holds true for bridge timbers, railings, posts, poles and other forms of timbers as well. The labor charges involved have become so excessive that for this reason alone it has become necessary in many instances to use treated timbers to avoid frequent and expensive replacements.

5. Marine borers, such as the teredo and the limnoria, have been very active in destroying piling, wharves and other timbers used in the waters of the Atlantic Coast south of Delaware Bay and throughout the Gulf and Pacific coasts, and have caused heavy losses. By the preservative treatment of piling, wharf timbers, etc., the work of these borers can be successfully checked.

PRESERVATIVES USED

The essentials of a good preservative are as follows: (1) it must be toxic, that is, poisonous to fungus growth; (2) it must be insoluble, and (3) it must not affect the strength of the timbers in service. The preservatives that meet these requirements to best advantage, and are also reasonably inexpensive and available for use in this industry, are coal-tar creosote and zinc chloride. Other forms of preservative, such as mercuric chloride, have been introduced and used, but have not given the satisfaction that coal-tar creosote and zinc chloride have given.

METHODS AND RESULTS[1]

Superficial Treatments.

In the early days of the industry, charring was commonly used in the case of piling, poles and posts. The pores of wood have also been treated by brush applications of paints and other preservatives, to prevent decay. Dipping, spraying, and other forms of application have been used with more or less success on wood used for certain purposes, but these methods have proved too superficial and not sufficiently durable to be successfully applied to cross ties, mine timbers, bridge timbers, etc.

[1] For detailed information regarding wood preservation, see the Proceedings of the American Wood Preservers' Association, Chicago.

Non-pressure Processes.

In the open-tank process, which has been applied to poles and posts, these materials are first subjected to a short period of boiling in the preservative and are then injected into a cold bath of the same preservative. The vacuum which is created in the wood fibers during the heating

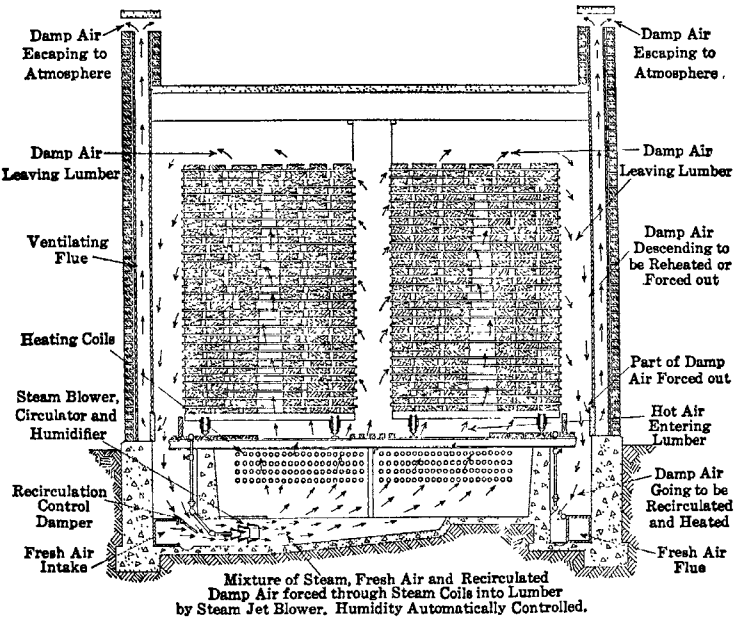

Damp Air Escaping to Atmosphere
Damp Air Escaping to Atmosphere
Damp Air Leaving Lumber
Damp Air Leaving Lumber
Ventilating Flue
Damp Air Descending to be Reheated or Forced out
Heating Coils
Part of Damp Air Forced out
Steam Blower, Circulator and Humidifier
Hot Air Entering Lumber
Damp Air Going to be Recirculated and Heated
Recirculation Control Damper
Fresh Air Intake
Fresh Air Flue
Mixture of Steam, Fresh Air and Recirculated Damp Air forced through Steam Coils into Lumber by Steam Jet Blower. Humidity Automatically Controlled.

FIG. 31*a*.—Cross-section of a recently developed type of steam jet blower kiln, showing circulation of hot and damp air through and around piles of lumber. Courtesy of the Henderson Drying Equipment Corporation.

process is released in the cold bath, giving a penetration of $\frac{1}{4}$ to $\frac{1}{2}$ inch or more.

Impregnation by Pressure.

The most successful method of preservative treatment is to inject the various preservatives into the wood fibers under heavy pressure. This is done at large plants where cross ties, timbers, or other materials to be treated are run into long cylinders from 100 to 150 feet or more in length, or small buggies or trucks. Many patented processes have been devised and are in common use on our various railroads.

The principal processes may be described as follows:

1. Bethell System. By this process green ties or timbers receive a live-steam bath at about 20 pounds pressure. A preliminary vacuum is created and maintained for a period of half an hour to an hour, or even longer, after which oil is injected under pressure and a maximum of 100 to 180 pounds pressure per square inch is applied until sufficient penetration is secured. After this the final vacuum is applied, to draw forth

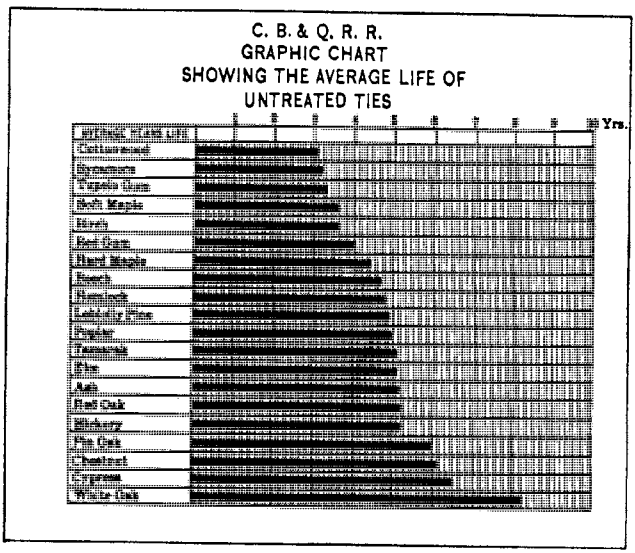


FIG. 32.—Results of extensive tests of the durability of untreated cross ties in service on the Burlington system. From 86 to 258 ties of each species were under test.

any surplus preservative. This final vacuum may be omitted in some cases.

2. Rueping Process. By this process the iron cylinder or retort is filled with compressed air, the pressure varying with the wood, its condition, species, etc. Creosote is then put in under pressure of 150 or more pounds per square inch, and this pressure is continued to "refusal," that is, until the wood refuses to absorb any more preservative. Sometimes a specified absorption of so many pounds of creosote per cubic foot is applied. After this a vacuum is applied to take out the excess oil.

3. Lowry Process. In this process the creosote is applied directly to the wood without any preliminary vacuum or compressed air treatment. The creosote or other preservative is applied until the desired

penetration is secured, after which the oil is drained off and a vacuum applied to take off the excess preservative.

4. Card Process. By this process a mixture of approximately 80 per cent zinc chloride and 20 per cent creosote is applied in various forms. The underlying principle, however, is that the cheaper zinc chloride can be used in connection with the more expensive creosote.



CHAPTER XII

EXPORT

GENERAL

THE exportation of lumber and other wood products has always been of considerable importance to the American lumber industry and to the economic welfare of the country. The large trees cut from the virgin American forests were found so desirable by foreign timber dealers, for ship-building and other structu al purposes, that the export of timbers, logs, planks, deals, and boards began in the earliest Colonial times.

The chief centers of export have naturally followed the great lumber-producing sections. In the early days, eastern white pine was the principal species exported and was shipped largely from Portland, Boston, New York and Philadelphia. Later, southern ports along the Atlantic and the Gulf became the principal exporting points, and more recently the Pacific Coast ports have assumed large importance in the lumber export trade. The principal exporting points in the south are New Orleans, Mobile, Pensacola, and Jacksonville; less important ports are Galveston, Port Arthur, Orange, Gulfport, and Savannah. Southern pine and hardwoods are the chief exports that pass through these points. On the Pacific Coast, the leading ports are Seattle, Portland, Bellingham, Everett and Gray's Harbor, Willapa Bay, and Coos Bay, and to a less extent Humboldt Bay, Tacoma, and Columbia River points other than Portland.

Only 3 to 7 per cent of the lumber production has been exported in the past. The high-water mark in quantity was reached in 1913, when about 3 billion board feet were exported; but the highest value was reached in 1920, when over $104,000,000 worth of timbers and boards were exported. This figure is largely explained by the fact that exceptionally high post-war prices were in effect during that year.

Practically all lumber and timbers are exported in the rough condition. This is due chiefly to the heavy import duties imposed by most foreign countries upon all forms of finished lumber; also to the fact that lumber exports are subject to rough and frequent handling, precluding shipping of dressed stock except in unusual cases.

Grades of hardwood sold in the export trade are generally the same as those sold in the domestic market. Numerous hardwood exporters, however, have established a market for special grades, which are identified by their special brands and sold on the basis of these marks in the same way as the Scandinavian softwood product.

The export grades of American softwoods are generally different from the domestic grades. Southern pine is exported under the Gulf Coast Classification of the Southern Pine Association; Douglas fir and other associated West Coast woods are graded according to the export rules of the Pacific Lumber Inspection Bureau; eastern spruce and white pine are exported under long-established export rules which have never been formally promulgated but which are generally recognized in the trade.

From time to time, the wisdom of restricting our export lumber trade, in view of the progressive depletion of our forests, has been discussed in the press and in legislative circles. The consensus of opinion among students of the subject is that there is a sufficient area in this country, suitable only for forest cultivation, to supply all domestic requirements and in addition furnish enough for an extensive export trade.

SPECIES EXPORTED AND COUNTRIES OF DESTINATION

The following table shows the principal species exported, according to the records of the Bureau of Foreign and Domestic Commerce.

UNITED STATES EXPORTS OF LUMBER (BOARDS, PLANKS AND SCANTLINGS)

	Southern Yellow Pine, M Ft.	Douglas Fir,* M Ft.	Oak, M Ft.	Gum, M Ft.	All Other, M Ft.	Total, M Ft.
Total, 1922	474,258	614,704	108,214	45,550	290,208	1,532,934
Total, 1921	432,736	455,233	68,600	27,634	220,605	1,204,808
Monthly average:						
1922	39,521	51,225	9,018	3,796	24,184	127,744
1921	36,061	37,936	5,717	2,303	18,384	100,401
1920	54,368	36,602	8,764	2,265	27,228	129,227
1913	100,432	56,302	22,108	6,510	12,653	198,005

The leading species exported in 1922 was Douglas fir, of which 614,704,000 feet were sent abroad, compared with 455,233,000 feet in 1921 and 665,295,000 in 1913. During 1922 nearly one-half of the Douglas fir went to Japan, nearly one-fifth to China, and the next largest quantities to Australia and Peru. The second leading export wood in 1922

was southern yellow pine, 474,258,000 feet being exported, as compared with 432,736,000 in 1921 and 869,737,000 in 1913. About one-fourth of the southern yellow pine exported in 1922 went to Argentina, one-sixth to Cuba.

Of oak, the leading hardwood exported, 108,215,000 feet were shipped abroad in 1922; 68,600,000 in 1921, and 287,855,000 in 1913. The United Kingdom and Canada are the principal countries to which oak is exported.

PRINCIPAL COUNTRIES WHICH IMPORT FOREST PRODUCTS FROM THE UNITED STATES

1921

Importing Country.	Value of Forest Products from the United States.	Importing Country.	Value of Forest Products from the United States.
United Kingdom	$16,204,391	Belgium	$1,736,294
Canada	15,318,058	Germany	1,681,907
Mexico	12,039,047	Peru	1,574,873
Japan	10,395,632	Spain	1,104,961
Argentina	6,212,208	Netherlands	965,188
Cuba	5,144,266	Panama	950,312
Australia	2,224,912	Honduras	852,615
China	2,222,447	Italy	808,981
France	1,888,183		

TOTAL LUMBER PRODUCTION AND QUANTITY, PERCENTAGE AND VALUE EXPORTED IN THE YEARS 1910–1921

Year.	Lumber Production, M Feet B M.	Lumber Export,* M Feet B M.	Per Cent of Annual Production.	Value of Exports in Dollars.*
1910	40,018,282	2,201,424	5.5	48,108,264
1911	37,003,207	2,702,768	7.3	59,432,746
1912	39,158,414	2,914,245	7.4	67,612,046
1913	38,387,009	3,047,092	7.8	73,204,046
1914	37,346,023	2,102,607	5.7	47,196,064
1915	37,011,656	1,306,950	3.5	30,090,709
1916	39,807,251	1,293,166	3.2	29,720,716
1917	35,831,239	1,177,723	3.3	38,072,525
1918	31,890,494	1,099,039	3.4	51,676,477
1919	34,552,076	1,493,603	4.3	73,004,352
1920	29,878,360	1,722,136	5.8	104,722,076
1921	26,991,798	1,340,271	5.0	49,835,139

* Includes sawed and hewn timbers, boards, deals, planks, joists, and scantlings.

FEATURES OF PRINCIPAL FOREIGN MARKETS

The United Kingdom, our chief market, has for a long time been an important buyer of yellow pine timbers and deals, Douglas fir timbers, white oak, red gum, sap gum and yellow poplar boards and hardwood logs, particularly white oak, red gum, black walnut, ash, yellow poplar and hickory logs. The important British ship-building industries require large quantities of merchantable yellow pine timbers in 30 and 35 cubic foot average. Large quantities of cross ties, called sleepers in England, are imported from the United States, especially Douglas fir and redwood and some southern yellow pine in 5×10-inch, 8 feet 6 inches and 9 feet long. Considerable prime boards and merchantable and prime deals are shipped to Liverpool and London. Hardwoods are usually purchased in firsts and seconds or "prime" grade in 4/4, 5/4, 6/4 and 8/4-inch stock. Thin poplar in various thicknesses less than 1 inch are in frequent request, as are also wide poplar, sap gum, and red gum, and occasionally red oak for coffin boards. Another feature of the English market is the demand for so-called wagon oak, used in car construction in sizes such as 6×12-inch and 5×12-inch by 16 feet long, and for so-called cabinet oak 3 inches and 4 inches by 8 inches and wider. Both yellow pine and Douglas fir ship-decking in 3×5, 4×5, 2½×5, and 4×4-inch, 20 to 40 feet long with 26 feet lineal average, are commonly in demand for the ship-building industries near Glasgow, Belfast, and Liverpool. Some kiln-dried saps, specified as dry and bright, are also sent to this market.

Argentina takes considerable quantities of yellow pine, with a little white oak, white pine, spruce, Douglas fir and red gum. The well-known River Plate yellow pine schedules usually call for 5 per cent of 1×3, 1×4 and 1×6-inch kiln-dried saps and 50 per cent of deals, small timbers, scantlings, and a small portion of boards. These schedules are looked upon with favor by southern pine mills that are located advantageously with reference to the shipping ports. Stock for Argentina must be dry and bright, and kiln-dried saps are generally specified to be 80 per cent free of knots.

The export trade to Canada is handled in the same way as the domestic trade. It is an important market for our hardwoods and cypress.

Japan has become an important buyer of Douglas fir timbers within recent years, especially of so-called "Jap" squares, 12×12 to 24×24 inches, 24 to 40 feet and longer. This market also purchases a number of western red cedar bolts or flitches.

Australia, on account of its limited forest resources and rapid growth in population, has for a long time been an important buyer of Douglas fir timbers and deals and redwood boards and planks.

China has developed into a very important market, particularly since the war, for Douglas fir timbers, deals and boards.

The west coast countries of South America, particularly Chile and Peru, are important purchasers of Douglas fir timbers, deals and boards,

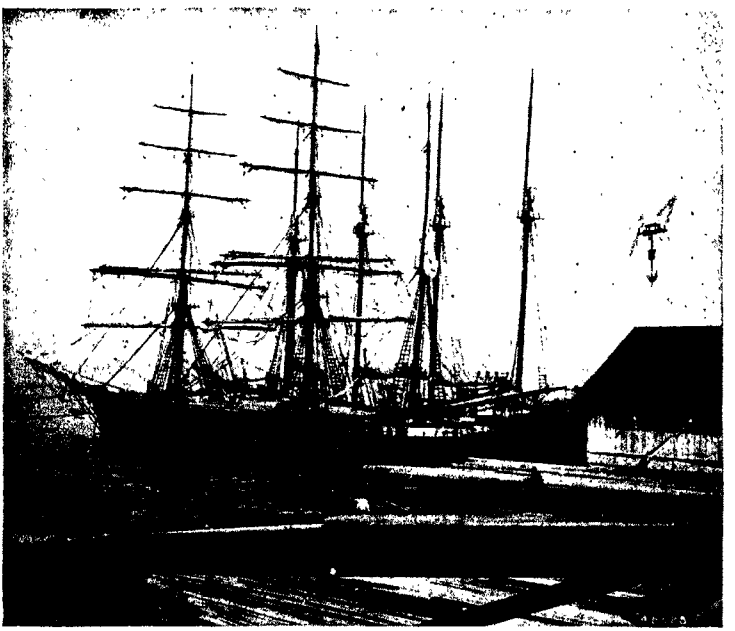


FIG. 33.—Large vessel loading Douglas fir at one of the large cargo mills in Washington. An important export trade has been developed from the Northwest to the Far East, Australia and the West Coast of South America. (Photograph by the U. S. Forest Service.)

especially for the copper and other mines and general construction in these countries.

Cuba, Porto Rico, and the other West Indian Islands, are important buyers of comparatively cheap American lumber, particularly southern yellow pine. Their requirements are largely boards, scantlings, and small timbers. The usual specification is for square edge and sound. As periods of activity and depression frequently succeed each other, the Cuban market is rather spasmodic. In many instances, the market

will take our domestic sizes in No. 2 common boards, and in extreme cases No. 3 common boards.

Mexico, since the development of its important oil fields in the vicinity of Tampico, has taken large quantities of medium grade yellow pine timbers, deals, scantlings, and boards. The Mexican market will also take domestic grades.

Belgium and Holland for a long time have been important purchasers of yellow pine timbers and deals of the better quality. They prefer a rather large cubic average in timbers. Considerable prime and kiln-dried saps are also shipped to these countries for the better classes of heavy construction, as well as for flooring, furniture, doors and shipbuilding purposes.

Germany was an important market prior to the war, for hardwood logs, yellow pine timbers, deals and prime boards, and firsts and seconds in white oak, red and sap gum, yellow poplar, and ash. Germany has generally been the purchaser of the highest grade stock of all species shipped from this country, particularly rift, prime, 1×4 boards, prime deals and large-sized timbers with high heart specifications. Germany has been a very important buyer of walnut logs, used to a considerable extent in the manufacture of gun stocks, fine furniture, and cabinet work.

France is also a high-grade market, taking so-called French prime in yellow pine boards and to some extent prime deals and high cubic-average timbers. Since the World War, however, France has not been an important buyer of American lumber because of the prohibitive exchange rates.

Spain has for a long time been an important market for yellow pine merchantable timbers and deals. This country is essentially a deal market in 3×9-inch, 4×9-inch and occasionally 3×10, 3×11, 4×11 and 4×12-inch, 12 feet and up. Spain also purchases small quantities of kiln-dried saps with 90 per cent FOK specification, some prime boards in 1×3, 1×4, 1½×4-inch, 12 feet and up, and small lots of both firsts and seconds and No. 1 common white oak, red gum, and sap gum in 4/4, 5/4, 6/4 and 8/4 inch thicknesses.

Italy has for over fifty years been an important purchaser of yellow pine timbers and deals. A special grade called Genoa prime, as applied to deals and boards, is recognized in the trade. The boards are usually 2×9 inch and up, 2½×9 inch and up, and 3×9 inch and up, 12 feet and longer. This market also purchases small lots of both firsts and seconds and No. 1 common red gum and sap gum.

Other foreign markets of less importance are South Africa, which

purchases chiefly yellow pine and Douglas fir timbers and deals; Egypt, which purchases cross ties, red gum, yellow pine, and Douglas fir from this country; Greece; Portugal; India; Brazil; Paraguay; Uruguay; Venezuela; the Guianas; and the Central American countries.

WORLD COMPETITION

The United States is a relatively small factor in supplying the lumber requirements of the rest of the world. It is the greatest lumber-producing and wood-using country in the world, but it enters into the world's markets on a comparatively small scale. The most important lumber-exporting countries prior to the World War were Austria-Hungary, Sweden, Russia and Finland. These were the most active competitors of the United States, sending their lumber and other forest products not only to western and southern Europe but to the Mediterranean section, the east and west coasts of South America, and to Australia and South Africa. Since the war, Sweden and Finland have become the most highly developed and active exporting countries in the world.

Northern European countries, particularly Russia, Sweden, and Finland, have large quantities of surplus lumber which enter most prominently into the world's lumber markets. The species exported are the Swedish pine (*Pinus sylvestris*) and spruce (*Picea excelsa*), called respectively redwood and whitewood in the English market. These are used particularly in the great lumber-importing markets of the United Kingdom and in all the other countries just mentioned. Some of this pine has even been shipped from Scandinavia to the United States, in 1923.

As both the pine and the spruce from Scandinavia and Russia are usually grown under a system of forest management, they are cut from relatively small trees. Consequently, only small sizes are obtainable; practically no clear boards are sawed; and all the lumber has small, tight, live knots which are not discriminated against in Europe and South America to the same extent as in this country.

These two woods furnish the great bulk of the requirements for cheap lumber in Europe, that is, for the ordinary forms of construction as well as for box boards, etc. For the better classes of construction, such as ship-building timbers, and for heavy interior construction, southern pine and Douglas fir are imported from the United States. Because of the lack of available hardwoods, cabinet woods are imported from the tropics, white oak from Slavonia, the United States, Poland and Japan, teak from India, and red gum, yellow poplar, sap gum and a few other hardwoods from the United States.

American lumber does not presume to compete on even terms with the Scandinavian product, as it cannot be laid down in most of the world's markets on any satisfactory basis of price competition.

The following is a table of the forest areas of the principal lumber-exporting countries:

FOREST AREAS OF PRINCIPAL LUMBER-EXPORTING COUNTRIES

United States	463,000,000 acres
Austria-Hungary (now largely held by Roumania and Czechoslovakia)	53,000,000 "
Finland	53,000,000 "
Norway	17,000,000 "
Russia in Europe	465,000,000 "
Russia in Asia	384,000,000 "
Japan	58,000,000 "
Sweden	49,000,000 "
Canada	799,000,000 "

CHARACTERISTICS OF THE BUSINESS

Foreign Markets Independent of Domestic Fluctuations.

An important feature of the lumber export trade is that periods of activity or depression in this country are seldom reflected in foreign countries where American lumber is marketed. Consequently, in periods of domestic depression many concerns turn to those countries where the market for lumber is more active, and devote their attention to exploiting foreign markets under more favorable conditions than those prevailing at home.

Furthermore, foreign markets are wholly independent of domestic labor disturbances, railroad car shortage, and localized depressions or building activity, all of which have an important bearing on prices secured for lumber in this country.

Rates of Exchange.

Rates of exchange have a very important bearing upon the lumber export trade. It is obvious that unfavorable rates of exchange will have an important effect upon the purchasing power of any nation. This is particularly the case in Europe, which was in very urgent need of all kinds of lumber for its reconstruction requirements immediately following the World War. However, in spite of the urgent need for construction materials, the low value of the French franc, the Italian lira, the German mark, the English pound sterling, etc., in relation to

the dollar, prevented those countries from making large purchases of lumber from the United States. Rates of exchange, under normal conditions, are determined largely by the balance of trade between any two given countries. However, in the period following the World War, the kind and amount of currency in circulation has had an important bearing upon the rates of exchange and has acted as an artificial means of depressing the purchasing power of many of the European countries.

Conversely, when the value of the dollar is depreciated in terms of their own currency, foreign countries are in a favorable position to make important purchases of lumber. During the war, the value of the dollar was considerably depressed below the normal condition in Spain and some other countries.

With the return of the values of the English pound sterling to normal, the English market has once more become an important outlet for our export lumber; but the conditions of the exchange rates in France, Belgium, Italy, Germany, and other countries have militated against the usual purchases from the United States.

Possible Profits or Losses from Fluctuations in Ocean Freight Rates and Commodity Prices.

Practically all export lumber is sold on a C. I. F. basis, so that it is necessary for exporters to quote a price for their product delivered at a given port of destination, including the original cost of the lumber, insurance on the shipment delivered to warehouse or wharf at destination, and ocean freight. In view of the fact that considerable time elapses between the date of placing an order and time of shipment, particularly on stock which must be cut to order and then seasoned there is considerable likelihood of price changes in both the value of the lumber itself and the ocean freight rates. The latter vary with the supply and demand for space in the ocean carriers, whereas rail freights are regulated by the Interstate Commerce Commission and do not change with any degree of frequency. It is, therefore, highly necessary that the exporter " cover " his requirements on orders, unless he already carries the lumber in stock, as well as the necessary freight space. Sometimes the exporter, with his intimate knowledge of conditions, may count on a falling off in ocean freight rates as well as in the value of the lumber itself, and in this way can make even a larger profit than he had originally estimated. On the other hand, the likelihood of the loss is just as great. Following the war, ocean freight rates were exceedingly high, and for three years or more, starting from a high figure of $60 per thou-

sand board feet for moving lumber from the Gulf to North Atlantic Continental ports in Europe, the cost per thousand board feet varied from $50 to $12. Between these extreme limits, there were frequent rises and falls in ocean freight rates and more or less sporadic movements in the price of lumber.

Consignments.

The shipping to the various foreign markets, of quantities of unsold lumber and timber, usually referred to as consignments, has been highly injurious to the business in the past. Many American manufacturers, and in some cases exporters, finding it difficult to move their stock promptly in the domestic trade, frequently ship both small and large lots to foreign markets in the hope that they may be sold under advantageous conditions. As a rule, the foreign brokers and importers are apprised of these shipments, in advance and naturally take advantage of the situation to purchase them as cheaply as possible. This causes a depression of the market for shipments made in the usual way, resulting in serious injury to the export trade, particularly in the markets of the United Kingdom.

Sometimes American shippers unfamiliar with the demands of the foreign markets will ship sizes and grades which are sold with great difficulty or are wholly undesirable.

Hardwoods have been shipped on consignment more frequently than softwoods.

After a period of dullness in the foreign trade, when business has become more active and prices have begun to rise, exporters sometimes ship consignments in the hope that the rise in values will continue. This often results in "breaking" the market and stopping a normal development and growth in activity. Although repeated warnings against this practice have been issued by associations of exporters and manufacturers, it is still indulged in by many companies and results in conditions prejudicial to their interests as well as to those of their competitors.

METHODS OF CONDUCTING BUSINESS

In this Country—Webb Act.

Lumber exports from this country are handled almost entirely by exporters, who occupy the position of the middleman, or by groups of manufacturers or exporters organized into combinations under the

Webb Act. The latter permits groups to attempt to set or maintain prices in foreign markets for American lumber—a practice which the so-called Sherman Anti-Trust Act specifically prohibits in the domestic trade.

There are several large organizations, now operating under the Webb Act, which represent Douglas fir, redwood, southern pine, North Carolina pine, and southern hardwoods. Generally they are organizations of manufacturers who pool their interests in exploiting foreign markets.

Many attempts have been made by individual manufacturers in this country to trade directly with the importer or wholesale yard in foreign countries, but little success has attended these efforts.

Exporters are usually located at the principal lumber-exporting ports, such as New Orleans, Mobile, Seattle, Portland, and at New York City. These concerns have their own connections, such as agents or brokers in foreign markets, and purchase their requirements from various mills. They occupy a position similar to that of the wholesaler in the domestic trade. They acquaint themselves with the demands and the peculiarities of the various markets in foreign countries and also know the character of stock and the facilities and limitations of the various mills which are in a position to supply their requirements.

Both the individual exporters and those organized under the Webb Act ship in both parcel and cargo lots.

Abroad—Agents, Brokers, Importers.

The export lumber business is handled abroad, through intermediaries, in much the same way as it is handled in this country.

The intermediaries through whom the business is handled in foreign countries may be briefly described as follows:

1. Agent: Foreign agents perform a service very similar to that of the commission man in this country. That is, they operate as the agent of the exporter in this country and work on a commission basis or for a salary in the same way that the salesman or commission man operates in the domestic market. The agent's field of operations may be an entire country or continent or may be limited to one city or district. That is, an American exporter may be represented by an agent in each of the principal foreign lumber-buying ports. The agent works up sales with the foreign importers and, after correspondence or cabling, closes the sale and forwards the contract, which is made out between the shipper in this country and the importer in the foreign port. Thus, the agent is

not a party to the contract but merely serves as the intermediary between the buyer and seller.

2. Broker: The broker has for a long time been a very important factor in the export lumber trade. He has capital invested in the business and sells entirely in his own name. On the other hand, while he buys in his own name he does not do so as a wholesaler. His profit is limited to a fixed brokerage fee. The transaction is consummated by him in his own name, but not as a principal. The buyer is unknown and unnamed to the seller and vice versa. In other words, the broker makes a contract both with the shipper and with the seller and secures his fixed brokerage or commission. The brokerage includes the *del credere* or the guarantee of the financial responsibility of both parties. In case of a dispute, he endeavors to serve the interests of both parties to their mutual satisfaction. The brokerage ranges from 4 to 5 per cent, depending upon the trade customs in each market and also upon private negotiations. It is generally computed that two-thirds of this represents a commission or brokerage charge and one-third the *del credere*. The broker finances the business by permitting the seller to draw on him for 80, 90 or 100 per cent of the invoice value, for which he receives 2½ per cent discount, but he must allow a similar discount to his customer for cash payment. The broker frequently extends credit from thirty days to four months to the buyer. Goods are payable on arrival, and although the broker obtains discount for cash he charges the shipper interest on the amount advanced until the time of arrival when the account is payable.

3. Importer: The importer is the wholesale distributing merchant, who usually maintains a large yard at the seaboard with a considerable supply of stock, which he sells to the local consumer, that is, the ship yards, furniture factories, flooring manufacturers, box manufacturers, railroad shops, and other users of imported lumber. He buys on favorable terms, that is, usually on a long credit basis, through the agent or the broker. Generally he does not purchase in sufficiently large quantities to justify his buying directly from the manufacturer or shipper in this country.

Terms of Payment.

Lumber shipped to foreign markets is sold under terms which vary even more than those prevailing in the domestic trade. American business concerns generally are not as experienced in the export trade as

those of England. The time elapsing between the order and the arrival of goods, and the distance between the buyer and seller make the consummation of business much more difficult than in the domestic trade.

American banks doing an international business have aided very materially in the handling of this trade in recent years, particularly since the war.

There are no credit-rating agencies that give the ratings of foreign concerns. Some of the large banks doing an international business can furnish information on the more important foreign firms, but very often such information must be obtained by special investigation, which requires considerable time.

For some time, American exporters of all commodities have customarily demanded cash against delivery of documents in some American bank, so that they could receive payment for the goods as soon as shipped. Although this is highly satisfactory to American shippers it is prejudicial to the upbuilding of an active trade, as foreign importers and brokers are naturally averse to paying for goods before they are received and before they have had an opportunity to inspect them.

In general, the following are the principal terms of payment:

A. Cash against delivery of documents in an American bank. This is done by the establishment of an irrevocable credit by the foreign buyer, who instructs his bank to make payment against the delivery of certain documents and specifications calling for the shipment of certain kinds and forms of lumber. As just explained, few foreign concerns are willing to make payment on this basis and relatively little of the export lumber business is handled in this way.

B. Draft with ocean bill of lading and other documents attached, payable at sight or three days' sight on delivery of these documents to the buyer in the foreign port. This is a very common method of shipment, particularly if the business is done through some foreign broker who customarily pays on this basis. The American shipper has this draft discounted at his bank, and thus the funds become immediately available to him.

C. Bank guarantee in some foreign bank for payment in cash or at thirty, sixty, or ninety days from date of shipment, in accordance with contract terms. The buyer establishes a guarantee with his bank either on a credit basis or by actually putting up a certain sum of money as a guarantee, and in turn this foreign bank gives its guarantee to the American shipper that payment will be made in accordance with the terms. Usually, deferred payments of sixty to ninety days or more

from date of shipment are permitted. This insures safety to the shipper, as well as giving the buyer a longer time in which to make payment.

D. Open account with ninety or more days' credit. This is only done where the shipper is well acquainted with the buyer and business has been handled in this way in the past, or where sufficiently intimate relations are established to justify confidence in the payment of the account. Relatively little business is handled in this way, however, because the shipper cannot discount drafts or other paper and secure his money. This consequently means the employment of large amounts of capital as the shipper's funds are tied up over considerable periods of time without liquidation.

Documents.

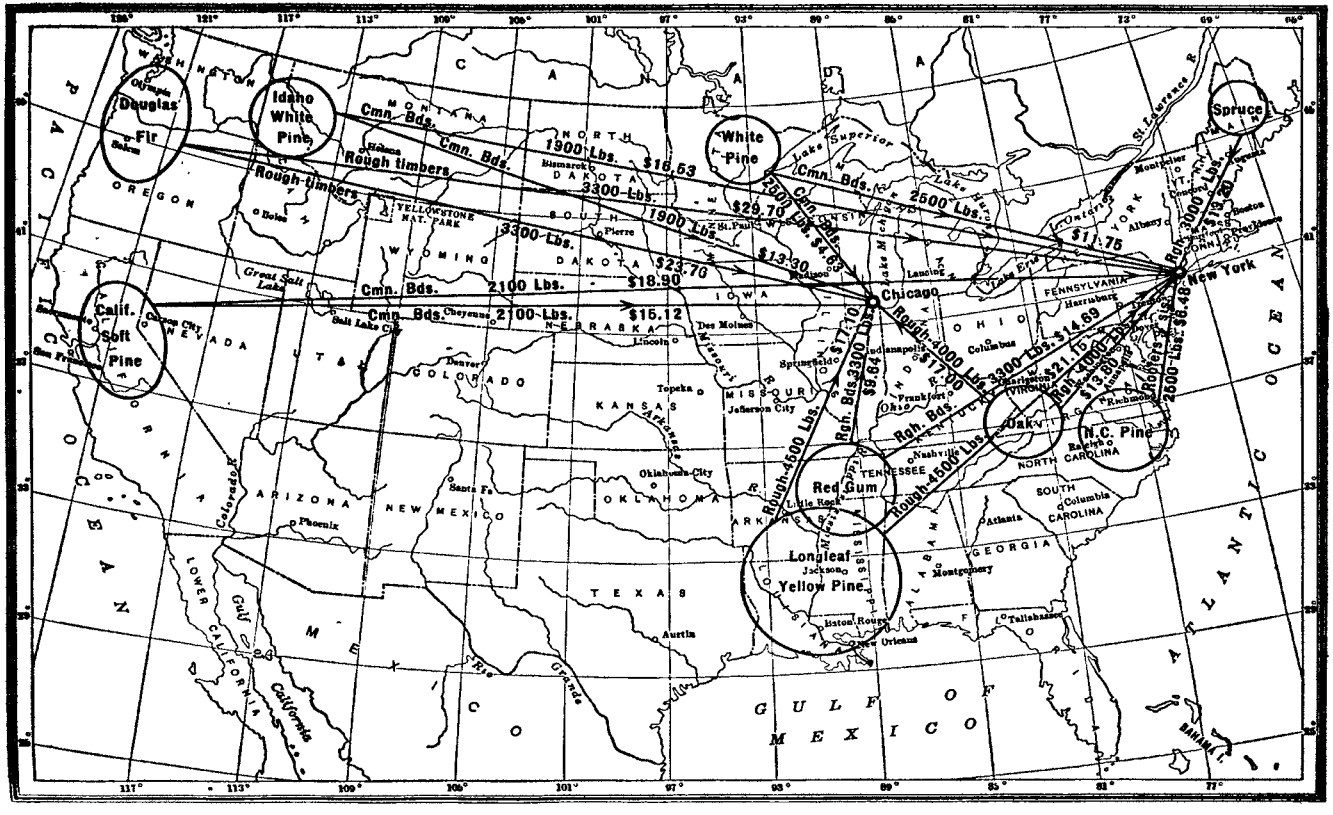
The preparation and the handling of documents is one of the most important features of the lumber export trade. Great care must be exercised to observe the terms of the original contract or the terms of the bank credit. A great many difficulties in the export trade are directly traceable to careless preparation of documents. The principal documents involved in export transactions are the ocean bill of lading, insurance papers, draft, invoice, inspection certificates, and specifications. In addition, the buyer may also require a certificate of origin, a consular visé, or a consular certificate or invoice. This depends very largely upon the customs and the import regulations of the various countries involved. On all export shipments the exporter must make out an export declaration of the quantity and value of goods exported. This is used to compile export statistics by the Bureau of Foreign and Domestic Commerce.

The ocean bill of lading is probably the most important document. Time of shipment is usually determined by the date on this bill of lading, but of late it has frequently been decided that the date of the railroad bill of lading from an interior mill is the determining date of shipment, unless it is specifically agreed in advance that the date on the ocean bill of lading decides this. Very often a separate bill of lading is required for each carload, even if a number of carloads constitute one shipment. It is exceedingly important to have clean bills of lading, that is, bills of lading without any marks indicating that the steamship line will suffer no claims for damage, breakage, discoloration, or shortage in count. Many banks refuse to handle other than clean bills of lading.

In many transactions it is necessary to secure from eight to twelve copies of each of the documents. Banks generally require three original

PRINCIPAL PRODUCING REGIONS AND MARKETS

WITH COSTS OF RAIL FREIGHTS IN 1923 ON MAJOR SPECIES PER M.B.F.



ocean bills of lading and original and duplicate copies of the draft, insurance certificates in triplicate and other papers in equal amount. Copies of each of the papers in every transaction are usually sent to the agent, broker or importer in the foreign country, and extra copies are made out for the steamship line and in some cases for the bank, the ship broker and other parties involved.

Inspection certificates issued by the National Hardwood Lumber Association, as well as those issued by the Pacific Lumber Inspection Bureau, are generally recognized and accepted in the lumber trade. Many other forms of certificates are used, but do not have the recognition and common acceptance that these two enjoy. However, certificates issued by the Southern Pine Association have acquired practically equal recognition and importance.

Codes.

It has been estimated that two-thirds of all American export business is transacted by cable. By translating cable messages to code form great economies are effected.

Every firm doing an export business registers a cable address with the cable companies and places on its letterhead its cable address and the names of the codes used. Cabling is very commonly resorted to, and by the proper coding of messages a few words may be made to represent a long typewritten letter. For example, the word "Timberco," followed by the address "London" when used on a cable will cause it to be delivered to the proper company at the address registered with the cable company, and may refer to the British Timber Company, 568 Strand, E. C. London. In the same way, the signature "Amwoods" may indicate to the receiver, for example, that the cable was sent by the American Lumber Co., 30 Church St., New York City.

Every word in a cablegram must be paid for, including address and signature. In the body of the message either plain language or code words may be used. Code words are limited to ten letters each. There are generally special rates for week-end and delayed messages, but it is usually necessary to word these in plain language.

Many firms use five-letter codes, joining two code words to make one cable word. Some have private codes of two-, three- or five-letter words. In the case of two-letter codes, a combination of five-code words grouped together can be sent as cheaply as two five-letter code words, or one ten-letter code word.

Some of the most widely used international codes are the ABC, Liebers, Standard, and Western Union, which are translated into the languages of all countries where the export and import trade is active. Many export lumber concerns use these and also the Universal Lumber Code, but in the case of long-established concerns, private, two-, three- or five-letter codes are always used.

Cables sent in the morning are received in England in the late afternoon of the same day, while messages to South America are frequently delivered within two hours.

The following cable rates were in effect in 1923, from New York:

To	Full Rate Messages per Word, Cents.	Deferred Plain Langauge Messages per Word, Cents.	To	Full Rate Messages Per Word Cents.	Deferred Plain Langauge Messages per Word, Cents.
Albania	32	14½	Jugo-Slavia	31	
Algeria	29	14½	Liechtenstein	27	13½
Austria	30	15	Lithuania	33	
Belgium	23	11½	Luxemburg	27	13½
Bulgaria	39		Malta	32	16
Crete	35	17½	Monaco	22	11
Cyprus	42	21	Palestine	44	
Czecho-slovakia	31	15½	Poland	32	16
Danzig	27	13½	Portugal	35	17½
France	22	11	Roumania	33	
Germany	25	12½	Sarre Basin	27	
Gibraltar	36	18	Spain	33	16½
Great Britain and Ireland	20	10	Switzerland	27	13½
Greece	35	17½	Syria	48	24
Hungary	33	16½	Trans-Jordania	48	24
Iceland	28	14	Turkey in Asia	43	
Italy	26	13	Turkey in Europe	33	

To points in Africa, and to those in Asia and Australia reached via London, there is a reduction of 5 cents per word on full-rate messages.

Overnight cable letters to Great Britain (minimum twenty words) cost 6 cents per word.

Week-end letters to London, Liverpool, Bristol, Birmingham, Bradford, Manchester, Newcastle-on-Tyne, Glasgow, Edinburgh and Dundee, where the Western Union has offices, are 5 cents per word

(minimum twenty words). To all other places in Great Britain and Ireland the rate is 6 cents per word (minimum twenty words).

Arbitrage or trading messages identified as such and requiring special handling are 25 cents a word.

TRAFFIC

Ocean Rates—Steamers and Sailers.

In the early days of the export trade, a large proportion of the shipments were handled on sailing vessels. There has been a gradual falling off, however, in traffic on sailing vessels, because rates are being offered on steamers on a competitive basis and shipments are being made more and more in parcel lots. The high insurance rates on sailing vessels, compared to those on regular liners, and quick dispatch, together with the speed of the latter, have also helped to discriminate against the continued use of sailers, particularly for shipments from the Gulf Coast shipping ports during the summer hurricane season.

Ocean rates change from time to time with the supply and demand for space to the various ports of destination. Immediately following the war, rates were excessively high, so high, in fact, that it cost from $50 to $60 per thousand board feet to ship lumber from this country to Europe, whereas the present rates are $12 to $15, depending upon port of destination from Gulf ports.

Sailing vessels are now used largely for shipments of southern pine to the West Indian ports, and, to some extent, for shipments of fir from the West Coast. They are also used for lots of 300,000 to 1,500,000 board feet where there is only one consignee or possibly two located at the same port. It is seldom that sailing vessels will take cargoes for more than two ports. Steamers, on the other hand, will seldom make a separate port of call, either for loading or unloading, for less than about 300,000 board feet. Steamers are chiefly used for parcel lots or chartered for large cargoes. Sailers are used for cargo lots that are destined for unusual ports of call, such those of West Africa or the West Indies, where there is not sufficient water to permit of regular liner service.

The following shows the principal rates in effect in 1923 from Western Coast ports:

Lumber up to and including 5×5 inch, 20 feet and under, $11 per M.B.F. Lumber up to and including 24×24 inch, 40 feet and under, $12. Logs, mean Brereton scale, maximum tops 42 inches, maximum butts

42 inches, 20 feet and under, $16; bolts and cants, $12. Some Japanese steamers plying between the United States and Japan have been offered on a lump-sum basis in lieu of the above rates. Steamers with a capacity for more than 3,000,000 feet of lumber have been offered for a sum of $46,000, but this method of time or trip charter is generally unsatisfactory. Rates from Pacific ports to Australia range between $15 and $16; to the West coast of South America, $12–$14; to Cuba by way of the Panama canal, $13; to the Atlantic coast, $12 to $15. The rate for one cargo to Montreal in April, 1923, was fixed at $16. Two Japanese steamers were booked with cargoes to South Africa at $19.50 per thousand feet. Sailers to Australia carry lumber for a rate of $12.50 to $13.50.

The following table shows the ocean rates on lumber for shipment from New Orleans to the principal ports where southern pine, hardwoods, and cypress are shipped.

Parcel and Cargo Lots.

As already indicated, more lumber is being shipped in parcel lots of 1 to 10 carloads or more than ever before. Shipments of this kind are generally made from our principal ports, where regular liner service is available, as, for example, at New Orleans, Mobile, Baltimore, Norfolk, Seattle, Tacoma, and Portland. Rates on cargo lots are always less than on parcel lots; but buyers requiring cargo lots of 1,000,000 to 4,000,000 feet or more are seldom in the market and, owing to the sharp rise and fall in lumber prices, the disposition is to buy more and more in comparatively small lots. Cargo lots may move either by steamer or sailer. In the case of the latter, cargo lots may be from 300,000 to 1,500,000 board feet.

In loading cargo lots, care must be taken to prevent green or wet timbers or lumber from coming into contact with air-dried or kiln-dried lumber, such as the kiln-dried saps which enter very prominently into our export trade. In view of the fact that all ships are unloaded in reverse order with reference to the order of loading, particular care must be taken in stowing the vessel and keeping the different lots identified by proper stencils, paints, or other marks. Very often, large black lines are painted across the top of a given lot in the vessel's hold, to separate it from the next lot.

OCEAN RATES ON LUMBER IN MAY, 1923, QUOTED IN CENTS PER 100 POUNDS ON HARDWOODS AND PER 1000 FEET OF PINE, EXCEPT WHERE OTHERWISE SPECIFIED.

Destination.	Lumber and Timber.			Logs.	
	Heavy Hardwood, Cents.	Light Hardwood, Cents.	Yellow Pine,	Heavy Hardwood, Cents.	Light Hardwood, Cents.
London, Liverpool, Manchester	30	40	$12.00	30	35
Avonmouth, Glasgow, Dundee, Aberdeen, Hull	35	45	13.50	35	45
Belfast, Dublin	40	50	14.50	40	50
Newcastle, Leith	40	50	14.00	40	50
Havre, Bordeaux, Dunkirk	40	50	13.75	40	†40
Amsterdam, Rotterdam, Hamburg, Bremen	35	45	11.00	35	†35
Antwerp	40	50	12.00	40	†40
Gothenburg, Copenhagen, Bergen, Christiania, Stavenger	50	60	19.00	50	50
Stockholm	55	65	25.00	55	55
Bilbao, Oporto, Santander, Lisbon { Oak	50				
Bilbao, Oporto, Santander, Lisbon { Gum	$17.00*	.....	20.00	55	55
Barcelona { Oak	50				
Barcelona { Gum	$17.00*	.....	16.00	55	55
Marseilles	50	60	18.00	50	60
Genoa	40	50	15.00	40	50
Naples, Leghorn	40	50	15.00	40	50
Alexandria, Algiers	60	75	19.00	60	75
Piraeus	75	90	20.00	75	90
Salonica, Constantinople	90	$1.05	25.00	90	$1.05
Trieste, Venice	50	60	20.00	50	60
Canary Islands, Madera Islands and Azores	$18.00 per M feet on pine, 60¢ per 100 pounds on heavy hardwood				

	Heavy Hardwood.	Light Hardwood.	Yellow Pine.
Rio	$16.00 FFA*	$16.00 FFA*	$16.00 FFA*
Santos	16.00 landed*	$16.00 landed*	16.00 landed*
Montivedeo	16.00*	16.00*	16.50*
Buenos Aires	16.00*	16.00*	16.00*

* These rates per 1,000 feet.

† Cypress Logs 10 cents higher.

Chartering.

When a shipper has sold a sufficient amount to justify chartering a vessel in which to ship his lumber, he enters into a contract, called a charter party, to use a vessel for a given trip or on a time basis. Time charters are not nearly as frequent as trip charters. In the latter case, the vessel owners assume all the risks of the voyage, properly man and stock the vessel, and only agree to move the lumber to port of destination.

In charter parties the owners of the vessel usually agree to assume the cost of loading and unloading, but the question of time required to load and unload is also of great importance. Some forms of charter parties, such as the Pix Pinus form, stipulate that any time saved by the shipper in loading a vessel accrues to the benefit of the shipper, and in this way good profits are sometimes made. In these cases, loading is done continuously, night and day, in order to save time. On the other hand, money may be lost in attempting to accomplish these results.

Heavy charges for demurrage, varying from $150 to $500 per day with sailing vessels and from $500 to $3000 per day with steamers, are incurred by the shipper after the period of free time has elapsed. Sundays and holidays are excluded in computing time and the charter party generally stipulates a length of time in which the vessel may report. If it fails to report within this time the charter party is automatically canceled.

There are numerous other provisions in every charter party, governing conditions of loading, handling, relative amounts permitted on deck, the protection and covering of the deck load, and other matters which require expert knowledge of shipping conditions at the ports of loading and destination and the customary procedure governing matters of this kind.

When vessels are plentiful, charters can very often be made at a figure considerably lower than parcel rates.

Insurance.

All export shipments of lumber must be insured against loss. Marine insurance is a relatively involved subject, and the most important export lumber shippers usually have a blanket policy, issuing their own insurance papers and reporting to the insurance company the time of shipment, the vessel on which the lumber is shipped, the ports of shipment and destination, and the value of the shipment. Shippers generally add 10 per cent to the C.I.F. value, not only to protect the buyer

against possible loss en route to destination but to protect his prospective profit as well.

Rates of insurance differ with the various conditions involved. They are very much higher on wooden schooners than they are on steel schooners and much less on A1 steamers than on any class of schooners. Generally speaking, the conditions which govern the marine insurance rates are as follows:

1. The type, class, age, and condition of the vessel on which shipments are made. It is obvious that the insurance rates would be higher on a vessel which is not classed as being as seaworthy than on the very best steel steamers.

2. Passage under contemplation, including ports of shipment and destination.

3. Time of year. During the summer hurricane season from the Gulf, insurance rates are always much higher. This season is generally regarded as being from about July 1 to September 30, during which time storms are much more likely than at other periods of the year.

4. Part of vessel on which lumber is stored. Insurance rates are much higher on deck loads than on underdeck loads, the ratio being generally 3 to 1. It is also sometimes necessary to furnish a certificate showing that deck cargoes have been properly protected and lashed on board before insurance certificates can be issued.

5. In case of parcel lot shipments, the composition of the remainder of the cargo may have an important bearing upon the rate of insurance.

6. The type of lumber shipped; that is, whether rough or dressed, etc.

7. Whether lumber is to be taken on or discharged at more than one port. This is generally a minor consideration but in some instances may have an important bearing upon the rate of insurance.

On steamer shipments, insurance rates are generally from $\frac{1}{4}$ to $\frac{1}{2}$ of 1 per cent, whereas on schooners insurance rates may be from $1\frac{1}{2}$ to 3 per cent of the total C.I.F. value. For deck cargoes, rates are generally three times as great.

Transshipments.

Shippers often take advantage of combination rates to and from an intermediary port, thus making indirect shipments, which are cheaper in some instances than direct shipments. For example, it may be possible to ship cheaper from New Orleans to Ham-

burg and then to Alexandria than directly from New Orleans to Alexandria. The economic laws which govern and regulate traffic in the export trade often provide for similarly illogical shipments of this kind. Competition on the various routes, the supply of and demand for the vessels flying under different flags, and the urgency of cargo make possible the transshipment of lumber under advantageous conditions. In many cases there are no through sailings from the port from which the shipper desires to move his goods to the port at which he has made his sale. In this case it may be necessary to ship the goods to some larger port, such as Liverpool, Havre, or Antwerp and then transship them to the port of destination in view of the fact that vessels are available from Liverpool, etc., whereas they may not be available from the original port of the shipment.

The lumber exporter, therefore, must become very familiar not only with the usual ocean routes taken by steamers but with the possibilities of lower rates and accommodations by means of transshipment.

The handling charges at the port of transshipment are alway snecessarily high, as lumber is a heavy and bulky commodity, but even with this consideration it is sometimes possible to take advantage of an indirect movement over that of a direct sailing.

CLAIMS

Claims cases have always been an exceedingly important and sometimes disastrous aspect of the export lumber business. On a rising market or during a period of activity in most foreign countries, claims are not frequent and are of minor importance. However, on a falling market or during periods of depression, claims are frequently filed against the American shipper for one or more causes as listed below.

The National Lumber Exporters' Association has for some time maintained an expert hardwood man in England, largely to handle claims cases in connection with hardwood shipments by members of this association. Other American lumber associations have considered from time to time the advisability of maintaining a representative in foreign markets.

Some individuals maintain either permanent or temporary representatives to protect their interests in several of the foreign markets, chiefly to handle claims cases that may arise.

The customs of the timber trade vary so greatly in the different countries, and in many cases differ so radically from those obtaining in this

country, that American shippers sometimes do not understand the reasons for the attitude of some of the buyers in foreign countries.

No doubt many of the claims entered against American shippers are fully justified; but it is nevertheless also true that many of them are wholly unjustified and are based upon a desire to purchase goods at lower prices or to secure some rebate for an imaginary defect, shortage in count, or some other real or imaginary basis of claim.

The following are the principal reasons for entering claims:

For Quality.

Foreign buyers do not always accept our interpretations of the American grading rules, and there is too often an insufficient meeting of the minds, as expressed in the terms of the contract, as to the exact quality, sizes and condition of the lumber to be shipped. Foreign buyers are generally very strict and technical regarding questions of grade, grain and size. Some defects are regarded as more serious in certain markets than in others. For example, sap stain is considered a very serious defect in the markets of Argentina and Spain and in several other countries, whereas in our domestic markets a superficial sap stain which can be removed in dressing is not looked upon with disfavor for most purposes. Furthermore, most foreign markets are accustomed to take small, live tight knots without complaint, but are very much opposed to the large, loose, or black knots which frequently occur in virgin American trees and are seldom found in other parts of the world.

All lumber shipped is expected to be "cut full" or "plump." In many of the foreign markets which use the metric system, it is customary to measure all parts of each piece, and if there is a slight discrepancy on any side or end in any considerable portion of the shipment a serious claim is immediately entered. Buyers, therefore, in the lumber export trade are much more particular and exacting than they are in the domestic trade.

For Shortage.

It is exceedingly difficult to count the number of pieces, particularly of kiln-dried saps, prime flooring strips, or even 4/4 lumber of any kind, as it is loaded into the vessel from a barge or from the dock, on account of the accumulation of large numbers of pieces in a sling which is hoisted over the vessel's side and through the hatchway to the hold. Representatives of the owners of the vessel usually endeavor to check the count

of the shipper as to number of pieces, but seldom if ever make an attempt to check board footage. The ocean bill of lading usually reads a definite number of pieces " said to be " a certain number of thousand feet. In other words, it is practically impossible for those in charge of the vessel to check on the board footage loaded. Even if a careful count and measurement is made at the mill, the shipment seldom checks up exactly the same on arrival at destination. If the vessel receipts on its ocean bill of lading for a certain number of pieces, it is, of course, held responsible for the delivery of this number of pieces on arrival at port of destination. In this case any claim for shortage must be made against the shipping company rather than against the shipper. Claims for shortage are quite frequent, but the shipper is never given credit for an overshipment or for more pieces than are shown on the ocean bill of lading.

For Damage.

Lumber shipped in parcel lots on steamers which carry other cargo is very susceptible to damage, particularly if shipments of oils, greases, or other goods which are likely to discolor the lumber en route are placed in close contact with the lumber or above it. As deck loads are susceptible to damage by water, kiln-dried stock or hardwoods are practically never placed upon the deck. Deck loads are almost always made up of timbers and deals.

If wet or green lumber is loaded into the hold of a vessel which is not properly aerated or ventilated during passage, serious damage from mold, stain or discoloration, may result from the close stowing. If the vessel receipts for lumber received in good condition, it must, of course, deliver the same lumber in good condition to the buyer. In case stained or discolored lumber or pieces with broken ends are delivered to the vessel, the operating company usually protects itself by inserting a clause to this effect upon the face of the bill of lading.

Owing to the rough handling in loading and unloading vessels, considerable breakage occurs.

In all cases of damage, claims of this kind are entered directly against the shipping company, unless it protects itself by noting character of damaged lumber delivered to it. Very often, however, disputes may arise as to whether the responsibility rests with the shipper or the shipping company, and considerable acquaintance with the customs and usages of the trade is necessary in order to properly arbitrate or compromise these questions.

For Delayed Shipment.

The time between the date of accepting the order and the date of shipment may be from one to three months or more, depending upon the character of lumber ordered, the urgency of shipment, whether lumber is air-seasoned or artificially kiln-dried and whether it is to be sawed before shipment. Claims entered for delayed shipment are very frequent, as shippers sometimes find that they are unable to secure a vessel within the prescribed time, or car shortage or other traffic difficulties arise and prevent shipment within the stipulated period.

In all contracts covering export shipments, clauses are inserted that "*force majeure*" shall hold. That is, the shipper is not responsible for events beyond his control, such as floods and other acts of God, strikes, war, etc. The interpretation of these exceptions is not always uniform and many disputes arise over the liability and responsibility of the shipper. The matter of appraising the amount of claim, even in the case of a real complaint is often open to question. American shippers should establish a better system of arbitration to protect their interests in the principal foreign markets, preferably to be handled by those fully familiar with our systems of manufacture, grading and shipping as well as the conditions existing in the principal export markets.

CHAPTER XIII

IMPORTS

KINDS AND SOURCES

SINCE the early Colonial times cabinet woods from the tropics have been brought to this country for the manufacture of high-grade furniture, cabinet work, interior finish and trim, and veneers. The chief tropical species imported for these purposes has been mahogany, which for many centuries has represented the highest standard in cabinet and furniture construction. For a long time this wood came chiefly from British Honduras, and to a limited extent from Mexico, other Central American republics and the West Indies, but, within recent years the supply of mahogany has come largely from Africa. The African product is not the true mahogany (*Swietenia mahagoni*) but comes chiefly from a native African species (*Khaya senegalensis*) which closely resembles the true mahogany and has been demonstrated to be fully as good for the purposes for which mahogany is used. Philippine mahogany has also been brought to this country and has contributed prominently to our furniture and cabinet manufacture. This comes from a species resembling the true mahogany but not identical with it.

These mahoganies usually enter the port of New York and are shipped directly from their native sources of supply as well as through the Liverpool and Hamburg markets. Liverpool is the most important mahogany market in the world. The Philippine mahogany, however, comes both to San Francisco and to New York City. New Orleans is the port of entry next in importance to New York City, particularly for Mexican, Honduran and other Central American mahogany and tropical woods.

Spanish cedar has been imported to this country for many years, chiefly for the manufacture of cigar boxes, for which it is preeminently well fitted on account of the agreeable odor which the wood imparts to the cigars. Spanish cedar is also used for veneers and many other purposes and comes chiefly from Cuba.

The great bulk of lumber imported to this country comes, however, from Canada, and consists chiefly of Douglas fir from British Columbia and to a limited extent of western hemlock, western red cedar and western spruce which grow in association with Douglas fir. Fir logs, timbers, and lumber are shipped to the United States, which is one of the chief markets for the surplus produced in western Canada. Many logs produced in British Columbia are also sold in the log markets in the Puget Sound district. In eastern Canada large quantities of spruce are annually shipped, chiefly by water, from Nova Scotia and New Brunswick to Boston, New York, Portland and other North Atlantic ports in this country. This spruce competes actively with spruce produced in Maine, New Hampshire, the Adirondacks, and West Virginia. It also competes with hemlock, North Carolina pine, southern yellow pine, and Douglas fir in the northern Atlantic seaboard cities.

Large quantities of white pine produced in the Ottowa Valley and Georgian Bay districts of Ontario enter the American markets at Detroit, Buffalo, Tonawanda, and other ports of entry, and compete actively with white pine produced in Minnesota, Michigan, Wisconsin and the Northeast.

Other kinds of lumber entering in an unimportant way on our American markets are other tropical hardwoods, such as greenheart, Japanese oak, which has come into active competition with our domestic white oak in the Pacific Coast states and is an active competitor of American oak in the European markets, and a number of miscellaneous tropical hardwoods from Brazil, British Columbia, the Philippines and Africa. These woods are generally very hard and heavy, and are distinguished by an attractive grain and color.

Other forest products[1] imported to this country are materials for pulp and paper and pulpwood, which come principally from Canada; in 1921, 1,081,634 cords of pulpwood were imported, chiefly from Canada. Dyewoods, cork, rubber, and materials for tanning purposes are some of the other forest products brought to this country from foreign sources.

[1] For detailed information regarding principal forest products imported for domestic purposes, see Forest Products their Manufacture and Use, by Nelson C. Brown, John Wiley & Sons, Inc., 1919.

TARIFFS

For a long time the question of tariff to be applied on lumber imports has been discussed in Congress. Many have claimed that imports of foreign timber supplies should be encouraged in order to assist the nation in conserving its own forest resources, while many others have held that the lumber industry, on account of its great importance in furnishing a livelihood to so many people, should restrict competition from outside sources, particularly from Canada.

As a matter of fact, Congress has generally regarded with favor the importation of foreign lumber supplies without an exclusive or prohibitive import duty. The question arises chiefly in relation to Canada, which has large resources of spruce and white pine in the east and of Douglas fir, cedar, western spruce, and hemlock in British Columbia.

On the other hand, Canada acts as an important market for our hardwood, cypress, and other forms of lumber, so that the amount of spruce, cedar, Douglas fir, etc., imported from Canada is about balanced by the exports of other woods needed by that country and produced by us.

The table on page 229 shows the lumber and timber items in the tariff acts of the United States since 1872.

EFFECTS ON HOME INDUSTRY

During a period of several years preceding the World War, the imports of logs and lumber varied between 1,100,000,000 to 1,300,000,000 board feet, which represented only about one-third of the exports during the same period. Since the war, however, there has been a notable increase in the imports of lumber and other forest products, and at the same time there has been a considerable decrease in the exports of lumber and timber from this country. In the year 1919 imports exceeded exports by 100,000,000 board feet. The import and export trade with Canada is looked upon practically as part of the domestic business and is handled in the very same way.

With the exception of conditions in the extreme Northwest and in the spruce and white pine business, the imports of lumber have had practically no effect on the domestic lumber industry. The great volume of business, as has already been shown, is handled from Canada, and the relatively small quantities of mahogany, cedar, and Philippine mahogany are not of sufficient volume to affect the sale and supply of such woods as black walnut, red gum, etc.

LUMBER AND TIMBER ITEMS IN THE TARIFF ACTS OF THE UNITED STATES SINCE 1872

	Act of 1872.	Acts of 1874–1883.	McKinley, 1890.	Wilson Tariff, 1894.	Dingley, 1897,	Payne, 1909	Underwood, 1913.	Fordney,* 1922.
Logs	Free	Free	Free	Free	Free	Free	Free	$1 per M feet
Timber:								
Hewn or sawed	20 9/16 ad valorem	20 9/16 ad valorem	10 9/16 ad valorem	"	1¢ per cubic foot	½¢ per cubic foot	"	Free
Unmanufactured	Free	Free	Free	"	Free	½¢ per cubic foot	"	"
Round (not spars)	"	"	"	"	Free	"	"	"
Ship	"	"	"	"	"	½¢ per cubic foot	"	"
Wharf	20 9/16 ad valorem	20 9/16 ad valorem	10 9/16 ad valorem	"	1¢ per cubic foot	½¢ per cubic foot	"	"
Lumber:								
Sawed (rough)	$2.00 per M feet	$2.00 per M feet	$2.00 per M feet	"	$2.00 per M feet	$1.25 per M feet	"	"
Dressed, 1 side	2.50 per M feet	2.50 per M feet	2.50 per M feet	"	2.50 per M feet	1 75 per M feet	"	"
Dressed, 2 sides	3.00 per M feet	3.00 per M feet	3.00 per M feet	"	3.00 per M feet	2 00 per M feet	"	"
Dressed, 3 sides	3.50 per M feet	3.50 per M feet	3.50 per M feet	"	3.50 per M feet	2.37½ per M feet	"	"
Dressed, 4 sides	4.00 per M feet	4.00 per M feet	4.00 per M feet	"	4.00 per M feet	2.75 per M feet	"	"
Shingles:								
White pine	35¢ per M	35¢ per M	20¢ per M	"	30¢ per M	50¢ per M	"	"
All other	35¢ per M	35¢ per M	30¢ per M	"	30¢ per M	50¢ per M	"	"

* Reciprocral duty or logs of fir cedar or western hemlock.

† Timber, hewn sided or squared otherwise than by sawing (not less than eight inches square) and round timber used for spars or in building wharves, one-half of 1 per cent per cubic foot.

STATISTICS

The following table shows the quantity and value of imports during 1913, a representative year prior to the World War, and also for the last three years for which statistics are available.

QUANTITY AND VALUE OF LUMBER, TIMBER AND LOGS IMPORTED TO THE UNITED STATES

Article.		1913.	1919.	1920.	1921.
Cabinet woods:					
Cedar	M feet	17,580	8,583	8,254	7,522
	Dollars	1,009,688	591,809	729,754	520,756
Mahogany	M feet	70,958	42,678	52,607	43,443
	Dollars	5,029,513	3,973,072	7,192,891	4,555,921
All other	M feet	.....	7,599	14,053	6,173
	Dollars	1,400,343	705,722	1,330,487	635,805
Logs and round timber	M feet	144,482	93,356	76,212	132,275
	Dollars	1,543,545	1,690,672	2,060,188	2,391,716
Total pulpwood	Cords	1,034,885	1,047,299	1,241,444	1,081,634
	Dollars	7,007,350	10,458,753	16,902,939	15,387,355
Manufactures of lumber:					
Boards, planks and other sawed lumber	M feet	969,552	1,144,187	1,338,530	830,533
	Dollars	17,616,587	36,883,988	56,639,885	28,793,181
Boards, planks and other forms of sawed cabinet wood	M feet	.....	3,758	9,754	6,364
	Dollars	.....	284,421	967,402	547,040
Laths	M	611,679	802,651	441,567	806,385
	Dollars	1,747,053	3,037,000	4,172,595	5,180,825
Shingles	M	561,363	1,987,480	1,963,567	2,163,612
	Dollars	1,460,571	8,720,032	11,260,189	7,401,713
All other	Dollars	970,096	1,389,018	2,900,736	2,286,817
Timber, ship and other	Dollars	.....	297,205	562,694	145,817

PROBABLE FUTURE TRENDS

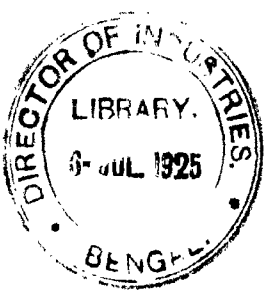
Many lumbermen and others who have concerned themselves with the economics of the industry, particularly with reference to the supply of forest resources, have exhibited an interest in various forests of foreign countries, in the hope that when our native resources were exhausted other supplies could be called in to improve the situation. It has been suggested that Russia and Siberia, with their enormous forest areas, could be used in the future for American lumber and timber requirements. It is not likely that we can count on these countries for any considerable share of our domestic requirements.

The tropics, to which many lumbermen have turned during recent years, offer only hardwoods of a very dense and heavy character, which are available for use only as furniture and cabinet woods and to a very limited extent as cross ties. With the South American hardwood forests within a comparatively short hauling distance of our present hardwood markets, it is likely that these tropical hardwoods will be used more and more in the future.

During recent years spruce and pine from Scandinavia have been brought to the Atlantic ports, particularly to New York, and during periods of activity and high price levels have been sold on a competitive basis for light dimension and common boards. These are the woods which enter so prominently in the United Kingdom where they are known as whitewood and redwood, respectively.

Slavonian white oak has also been brought to this country in very small quantities, in competition with our American white oak.

With the vast quantities of wood demanded by our American people, it is not likely that we can count on foreign sources of supply to meet our future requirements.



CHAPTER XIV

ASSOCIATIONS AND PROMOTIVE AGENCIES

ASSOCIATIONS

History.

The lumber trade associations of this country have been a very important factor in the development of the industry for the past thirty to fifty years. It was not until 1890 that they began to assume real importance, and since 1900, and particularly since 1910, their influence has been very marked and widespread.

The first trade associations were formed among the manufacturers, who met together informally to agree upon uniformity of grades and sizes. In the early days of the industry, in Maine, New York, and Pennsylvania, each mill developed a local clientele; the output of each was only a few thousand feet per day, and there was little necessity for organization. But with the rapid expansion of our population after the Civil War, and with the introduction of steam as a motive power for the circular saw, and still later, for the band-saw (about 1890), the importance of the lumber industry rapidly increased in the Lake States. It was found that, by organization, the manufacturers could cooperate to mutual advantage in the establishment of uniform grades and sizes. This was the object of the early associations and is still one of the chief functions of present-day activities among the manufacturers' associations.

Some of the earliest organizations of manufacturers were the Missouri and Arkansas Yellow Pine Association, formed in 1882, the Northwestern Lumber Manufacturers' Association, formed in 1883, the Southern Lumber Manufacturers' Association, in 1890, the Wisconsin Valley Lumbermen's Association, in 1890, and the Mississippi Valley Lumberman's Association, in 1891. In addition to the formulation of grades and inspection, some of the early associations were organized to assist in regulating production and the maintenance of proper price levels through dull periods. When active and prosperous times returned, these organi-

zations failed to function, and often their existence was sporadic and their efforts ineffectual.

Principal Activities.

Many of the associations have contributed greatly to an increased knowledge, both among the public and within the industry itself, regarding the technical features of the business and the character of their lumber products. They have also contributed materially to an observance of higher ethical principles in the handling and distribution of lumber, and have developed a spirit of healthy cooperation among their members, in place of the intense rivalry and competition which had heterofore marked the development of the American lumber industry. A finer relationship has, moreover, been created between the industry, the general public, and Government agencies.

The particular functions of the manufacturers' associations for the different groups of species have been the following:

1. Establishment of uniform grading rules.
2. Standardization of sizes and methods.
3. Inspection service.

The functions of the retail and wholesale associations have been largely educational. All of the organizations have more or less similar purposes; their great aims have been the dissemination of mutually helpful information, the standardization of their products, and the unifying of trade practices, etc.

There are many trade associations representing different phases of the lumber industry. The most important of these associations are the following:

(*a*) Manufacturers' associations.
(*b*) Wholesalers' associations.
(*c*) Retailers' associations.

There are also associations representing divisions of the industry and affiliated lines such, for example, as the following:

(*a*) Loggers.
(*b*) Exporters.
(*c*) Fire protective organizations.
(*d*) Cross tie manufacturers.
(*e*) Local organizations taking in retailers, wholesalers, and manufacturers' representatives.

(*f*) Box manufacturers.
(*g*) The cooperage industry.
(*h*) Veneer, furniture, chair, turpentine and other industries.

These associations may be national, regional, state-wide, or local in character. Among the retailers there is one central organization made up of regional and state associations. There is also one strong National Lumber Manufacturers' Association of Washington, D. C., and two associations among the wholesalers, namely the National–American Wholesale Lumber Dealers' Association of New York City, made up of both softwood and hardwood wholesalers, and the National Hardwood Lumber Association of Chicago, made up of both hardwood wholesalers and manufacturers. The latter has been most active and effective in the matter of grades and inspection.

Cooperation vs. Competition.

For some time, the underlying principle which has dominated American business has been that competition is the life of trade.

Lumber manufacturers and retailers who had similar interests formerly felt that a frank and frequent discussion of their mutual problems with competitors might result in injury to their own business. Within recent years, however, this has given way to a new spirit of cooperation between companies having mutual or similar interests and problems. This is the thought underlying all the association activities. In fact one very prominent lumber trade journal has adopted as its slogan the statement that cooperation rather than competition, is the life of trade.

Interchange of Information.

In the same way it has been generally considered helpful to have a frank interchange of information between competing companies. The compilation of statistics of costs, grades, etc., has no doubt contributed in a very important way to the standardization of the entire industry.

Governmental Relations and Limitations of Anti-Trust Law.

As a result of these new activities among the associations, the Government, through the Federal Trade Commission, has repeatedly endeavored to bring in findings against certain branches of the industry, to the effect that the interchange of price information has been in restraint of trade under provisions of the so-called Sherman Anti-Trust Act. More

than a decade ago, the former Bureau of Corporations endeavored to determine that a lumber trust in restraint of trade was in actual existence, particularly among the timber owners and lumber manufacturers. These attempts were repeatedly made, particularly by the Federal Trade Commission, and finally a decision was rendered against the former American Hardwood Manufacturers' Association. None of the associations are in such complete control of the output of their regions as to be in a position to maintain or regulate prices in restraint of trade. The lumber business is an extremely competitive one; there are over 30,000 producing units. Each concern is governed in its policy by its own financial and other restrictions and limitations, and it is highly improbable that any group within the lumber industry would be able to maintain prices which would be injurious to American business over any extended period or portion of the country.

Trade Extension and Advertising.

Trade extension and advertising have occupied the minds of the leaders of the industry, particularly among the more active and prominent associations. The principal activities along these lines are the following: the development of new uses, examples of which may be noted in connection with a number of woods and associations; efforts to combat the introduction and increased use of substitute materials, and to destroy popular prejudices which may exist in the minds of the buying public against either wood in general or particular species; the promotion of proper and intelligent building codes and regulations and the repeal of those which discriminate against the use of wood; the up-building of avenues of approach and undeveloped markets in foreign countries where American lumber can be used to greater advantage; and the branding and trade marking of lumber. The latter has been commonly used in many prominent lumber-exporting countries, such as Sweden, Finland, Norway and Russia, and has been practiced to some extent in the American lumber export trade. However, it has not been generally adopted by the manufacturers in the domestic trade.

Group advertising has been carried on very successfully, particularly by such prominent organizations as the Southern Pine, Northern Hemlock and Hardwood, Southern Cypress, California Redwood, and the Northern Pine associations.

Cost Accounting.

The lumber manufacturers' and retailers' associations have been leaders in the movement for the more widespread adoption of cost

accounting by the members of their associations. In some cases expert accountants, especially trained for this particular line of work, have been employed to study and put into effect a standardized method of cost accounting among the members of the retail and manufacturers' associations. An accurate and systematic comparison of costs may thus be obtained, and after averages have been made over a given period of time any single concern may determine for itself whether it is above or below the average of the competing members of the same association.

Conventions.

Lumber conventions, whether held yearly, monthly or quarterly, have made notable progress during recent years. They have served to stimulate the individual members to greater interest and effort and have offered a means of exchanging ideas and information of mutual interest and an opportunity for the various companies to put forth new ideas and agree upon new activities which will be of benefit to the entire group.

Methods of Support.

Associations of lumber manufacturers are maintained by assessments or contributions of member mills on the basis of output. This contribution has advanced from 1 cent to 50 cents or more per thousand board feet of output, although the usual basis is from 3 to 6 cents per thousand feet. On account of the increasing expenses for the maintenance of these associations, the assessment has generally been advanced during the past five to ten years, but the belief is common among the members that money paid for association support has been an excellent investment in every way.

Associations of wholesalers and retailers and other organizations in the lumber industry are maintained usually by annual dues, assessments for special services, and initiation fees. In some associations different charges are made for the various services, such as the credit and collection services, traffic bureau, trade information, inspection service, etc.

Activities of Typical Associations.

As pointed out earlier in this chapter, there are organizations of many varied and specialized interests within the industry. The manufacturers' associations as a group have been more active than those of any other branch of the industry, but they have been closely followed by the retail

Southern Pine Association

WEEKLY TRADE BAROMETER

No. 409

New Orleans, La., April 23, 1923.

For the Week Ended Friday, April 20, 1923,

134 MILLS REPORT:

Orders on Hand beginning of Week	**16,610 cars**	**355,321,120 feet**
Orders Received during Week	**3,446 "**	**73,716,832 "**
TOTAL	**20,056 "**	**429,037,952 "**
Shipments during Week	**3,393 "**	**72,583,056 "**
Orders on Hand end of Week	**16,663 "**	**356,454,896 "**

FOR THE WEEK (134 MILLS)	TOTAL	AVERAGE PER MILL
Orders	73,716,832 feet	550,126 feet
Shipments	72,583,056 "	541,665 "
Production	69,163,420 "	516,145 "
Normal Production These Mills	82,434,112 "	615,180 "

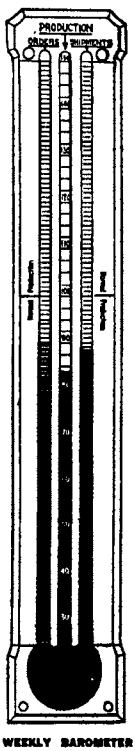
Shipments above Production for the week	3,419,636 feet	= 4.94%
Orders above Production for the week	4,553,412 "	= 6.58%
Orders above Shipments for the week	1,133,776 "	= 1.56%
Actual Production below Normal	13,270,692 "	= 16.10%
Shipments below Normal Production	9,851,056 "	= 11.95%
Orders below Normal Production	8,717,280 "	= 10.57%
Increase in "Orders on Hand" during week	1,133,776 "	= .32%

PREVIOUS REPORTS

WEEK ENDED	MILLS REPORTING	AVERAGE ORDERS (Feet)	AVERAGE SHIPMENTS (Feet)	AVERAGE PRODUCTION (Feet)	AVERAGE NORMAL PRODUCTION (Feet)	TOTAL UNFILLED CARS	AVERAGE FEET BOARD MEASURE PER CAR (Feet)
Jan. 26	127	795,858	625,903	554,471	635,941	18,535	3,395,116
Feb. 2	137	701,116	663,250	585,087	619,384	19,856	3,371,687
9	127	705,284	525,491	512,920	645,778	20,236	3,649,225
16	125	699,426	605,041	559,105	646,031	20,621	3,597,622
23	124	655,471	686,952	576,018	635,021	20,524	3,609,576
Mar. 2	126	554,489	628,276	595,403	632,523	19,833	3,432,553
9	125	597,539	600,332	590,339	636,526	21,305	3,441,302
16	127	555,954	538,494	521,522	645,515	21,149	3,291,680
23	129	434,972	585,630	588,481	643,434	19,499	3,223,879
30	129	415,055	537,042	553,174	633,964	18,133	2,997,227
April 6	129	503,611	572,415	535,248	644,509	18,114	2,994,146
13	126	511,344	566,783	517,427	628,370	16,690	2,824,451
20	134	550,126	541,665	516,145	615,180	16,663	2,660,111

31,393 feet is used as basis for ordered being average load shipped in March.

Those desiring this Barometer sent them regularly will receive it without charge upon application.



WEEKLY BAROMETER

Barometer indicates percentage of Production, Orders and Shipments above or below Normal Production, which is shown as "Zero" or 100%.

FIG. 34.—Weekly statement issued by the Southern Pine Association to keep its subscribers and others wishing it informed of conditions in the Southern pine industry.

and wholesale groups, the latter being more active in regional and statewide work.

The following brief descriptions are devoted to some of the outstanding associations, chiefly of the manufacturers' group which have achieved notable success in the field of association effort.

Northern Pine Manufacturers' Association, Minneapolis, Minnesota.

This is one of the oldest lumber associations in existence. For a long time it was also one of the most prominent, but with the cutting of the great virgin forests of white pine in Minnesota and Wisconsin the output of the mills within the association has gradually decreased until the normal annual output in 1922 was only 350,000,000 board feet.

This association was organized as the Mississippi Valley Lumbermen's Association in 1891. This was combined with the Wisconsin Valley Lumbermen's Association in January, 1906, under the name of the Northern Pine Manufacturers' Association. There were 69 members in 1895, 91 in 1901, 60 in 1915, and in 1922 there were only 9. The old Wisconsin Valley Lumbermen's Association, organized in 1893, had 22 members in 1898 and 15 at the time of consolidation, 1906. In 1910, the Northern Pine Manufacturers' Association had 46 members operating 57 mills. In 1913, there were 26 members with an annual production of 1,185,000,000 feet of lumber. The actual production in 1921 amounted to only 271 million feet, but this varies considerably from year to year with the condition of the market. There are only 12 mills now in the Association, representing both Wisconsin and Minnesota, but chiefly in the latter state.

The charge per thousand feet of lumber production for the support of the association has ranged in the past years from $1\frac{1}{2}$ cents to $8\frac{1}{2}$ cents.

The principal species cut, in order of importance, are white pine, Norway pine, spruce and tamarack. White pine, however, represents the great bulk of production.

Already efforts are being made to cultivate and encourage a second growth, as the virgin forests have been very largely depleted. As great areas of typical forest soils are represented in this region, it is unlikely that the present forest area will be decreased to any considerable extent. It will be a long time, however, before lumber resumes a position at all comparable with that which it occupied in the early part of this century.

This association was initiated and has been maintained more for the establishment of uniform grades of lumber and its inspection than for

any other purpose. It has held to this one principal activity throughout the major portion of its existence, and enters very little into the other activities so prominently emphasized by other associations, such as the West Coast Lumbermen's and the Southern Pine associations. However, in addition to grading and inspection of lumber, the Northern Pine Manufacturers' Association gathers information and statistics which are of value and interest to its membership. Traffic service is maintained principally to obtain sufficient cars for member mills, to assist in routing and diverting cars and in handling freight bills.

Southern Pine Association, New Orleans, La.

The Southern Pine Association was incorporated in 1914 and was formed by a reorganization of the old Yellow Pine Association with headquarters at St. Louis. This association is looked upon by organized American business at large as an admirable example of the effectiveness of association effort by a number of companies interested in the manufacture of a particular commodity. Largely through the efforts of the secretary-manager, formerly secretary of the National Lumber Manufacturers' Association, the Southern Pine Association has attained a position of great influence and prominence. It has, no doubt, contributed in a very material way to a better conduct of the lumber business, and to more helpful and cordial relations with the Government, and has done a great deal to put the entire industry upon a higher plane.

The Southern Pine Association has its headquarters at New Orleans and is composed of 157 companies, representing 197 mills located in eight different states, namely, Louisiana, Mississippi, Texas, Arkansas, Alabama, Florida, Georgia, and Oklahoma. These states are named in the order of quantitative production.

The association is supported by a subscription fee of 12 cents per thousand board feet placed upon actual production at the sawmill. This fee has varied from year to year, but with the increase in the activities of the association the tendency has been to increase the charge per thousand feet.

The Southern Pine Association has no doubt done more in trade promotion and advertising than any other lumber association. It represents the territory which has supplied the bulk of the timber supply of this country from 1900 to 1924, and the normal annual production of its member mills during the latter part of the above period has been from 5,000,000,000 to 6,000,000,000 feet annually.

The principal activities of this association are:

(*a*) Trade extension and advertising.
(*b*) Lumber inspection and grading.
(*c*) Department of accounting and economics.
(*d*) Compilation of statistics.
(*e*) Traffic department.
(*f*) Cut-over land utilization.

West Coast Lumbermen's Association, Seattle, Washington.

This is one of the younger of the lumber manufacturers' associations but is already very active. It bids fair to be one of the most prominent and influential of all of the lumber associations in the country on account of the large virgin timber supplies left in the Northwest and the likelihood that the output of this association will greatly increase in the future.

This association has two branch offices, one at Portland, Oregon, and the other in New York City. There are 185 companies represented in the association, with practically an equal number of mills in the western portions of the states of Oregon and Washington, west of the Cascade Mountains and in the southern section of British Columbia.

This association is a consolidation of three former organizations, the oldest of which was the Pacific Coast Manufacturers' Association, organized in 1905. The West Coast Lumbermen's Association has continued under its present name and in its present form of organization since the year 1911. The secretary-manager has built up the association to a position of great prominence and influence. The annual output of the member mills is about 5,000,000,000 board feet. In periods of depression, however, the output falls off considerably, whereas in periods of activity and prosperity the annual production is likely to increase beyond this figure. The association is supported by dues recently set at 5 cents per thousand feet.

The principal species cut is Douglas fir, which grows to its maximum size and best quality in this region. Other species of trees cut in order of importance, are western hemlock, Sitka or western spruce, western red cedar, and Port Orford cedar. These five species represent practically the entire production of the association, but there is a small quantity of noble fir, white fir, western soft pine and western white pine cut by a few of the mills.

As over one-half of the total remaining timber supply of the country

is located in the five northwestern states, and over one-fifth of this supply in the state of Oregon, while the resources of the Southern States are waning, it is very evident that this association will assume much greater importance in the future. The nation's lumber supply may naturally be expected to come more and more from the two northwestern states of Washington and Oregon.

North Carolina Pine Association, Norfolk, Virginia.

This is probably the oldest of the lumber manufacturers' associations. It is claimed that as early as 1625 a sawmill was established on the falls of the James River at the present site of Richmond. In 1888, the first organization of manufacturers was formed among the operators in the environs of Norfolk, called the Carolina Pine Lumber Association. This association lasted only a year and was succeeded by the North Carolina Pine Lumber Company, which undertook not only to perform the usual duties of an association but to buy up surplus stocks of lumber to prevent the market from becoming overloaded. This organization was reorganized from time to time and lasted through many difficulties and vicissitudes.

Finally, in 1897, the North Carolina Pine Association was organized, embracing manufacturers of both rough and dressed pine in Virginia and North Carolina; and in 1905, the South Carolina Lumber Association, embracing manufacturers in South Carolina, was merged with it. From an output of about 50,000,000 board feet cut by the manufacturers in the Norfolk district in 1888, the association has grown to an annual production well over 1,000,000,000 feet.*

There are 106 companies in this association, representing 117 mills in five different states, namely, Virginia, North Carolina, South Carolina, Georgia, and Alabama. Up to November 15, 1919, the association was supported by a charge of 8 cents per thousand feet on pine and 4 cents on hardwood. From that time to January, 1922, the assessment was increased to 15 cents on kiln-dried pine, 8 cents on hardwood, and 10 cents on air-dried pine. In 1922, the charge was changed to 10 cents on kiln-dried pine, 5 cents on air-dried pine, and 6½ cents on hardwood, with a monthly minimum of $15 on kiln-dried and $10 on air-dried pine.

North Carolina pine is made up chiefly of shortleaf pine with a small mixture of loblolly pine. The manufacturers of this district also produce small quantities of hardwoods, chiefly red and tupelo gum, yellow poplar, red oak, ash and sycamore, and a little cypress.

The principal activities of this association are as follows:

(*a*) Inspection service, which is responsible for standardized sizes and grading rules.
(*b*) Market information, including the collection of information and its dissemination among members.
(*c*) Cost accounting.
(*d*) Traffic department, including the maintenance of a separate office at Washington, D. C.
(*e*) Legal department.
(*f*) Statistical department.
(*g*) Trade promotion.

The Northern Hemlock and Hardwood Manufacturers' Association, Oshkosh, Wisconsin.

This is one of the oldest associations among the lumber manufacturers, having been organized in 1910 from two earlier organizations, both started in 1895.

There are about 100 companies in the association, operating about 100 mills in two states, namely, Wisconsin and Michigan. The normal annual output is 700,000,000 board feet but this varies with the condition of the market between 500,000,000 and 1,000,000,000 board feet.

The principal species produced by this association, in approximate order, are hemlock, maple, birch, beech, ash, elm, basswood, oak, and comparatively small quantities of Norway pine, white pine, and tamarack.

The Association is supported by dues based upon mill production. These dues, from 1915 to 1920, were 4 cents per thousand board feet; in 1921 the dues were raised to 6 cents per thousand board feet. Added income was secured from certain contracts through the organization of a Hemlock Bureau within the association in 1915, under which many members agreed to pay $7\frac{1}{2}$ cents per thousand board feet for hemlock, the additional income to be expended for advertising purposes, and in 1916 a similar group voluntarily agreed to pay 25 cents per thousand to advertise and promote the sale of birch over a period of five years. In 1922 the hemlock advertising was discontinued and the birch assessment of 25 cents was made an association assessment; thus making the rate 6 cents for all woods and 25 cents on birch, or a total of 31 cents for birch in the year 1922.

The work of the organization is largely carried on through the following bureaus:

(*a*) Bureau of statistical and educational information.
(*b*) Bureau of promotion.
(*c*) Bureau of grades and inspection.
(*d*) Bureau of transportation at large.

In addition to these bureaus, special committees are appointed from time to time to handle various important phases of the association's efforts as they might arise.

The association has done a great deal of excellent promotion work, including the exhibits of woods at various state fairs, some very efficient advertising in popular and technical magazines and trade journals, and various other lines of general promotion work, including the issuance of bulletins and publications on the various woods manufactured.

The Western Pine Manufacturers' Association, Portland, Oregon.

This association is composed of the principal lumber manufacturers of the Inland Empire, made up of western Montana, Idaho, eastern Washington, and central and northeastern Oregon.

Within this region are the best producing forests of Idaho white pine as well as some of the best western soft pine, also called western white pine (*Pinus ponderosa*), western larch, and scattering forests of Douglas fir, white fir, cedar, and spruce. In western Montana the principal trees cut are western soft pine, western larch and Idaho white pine. In northern Idaho the principal trees are Idaho white pine and western larch; and in southern and central Idaho, western soft pine. The principal species cut in eastern Washington and Oregon, within the scope of this association, is western soft pine.

There are 55 companies in this association, representing 62 mills. The normal annual production of these mills is 1,500,000,000 board feet. It is likely that this output will be maintained for some years to come, as there is a very abundant virgin supply in this region, particularly in northern Idaho. In order of production, this is the third most important association, being exceeded in output only by the Southern Pine and West Coast Lumbermen's Association.

The association is maintained by a charge which has varied in the past from 1½ cents per thousand board feet in 1910 to 8 cents per thousand board feet in 1922. The secretary of this association has made it one

of the outstanding examples of accomplishment in association work, both in its own region and in national affairs as well.

The principal species cut, in order of importance, in this region between the main divide of the Rockies and the Cascade range, are western soft pine (also called western yellow and western white pine), Idaho white pine, western larch, Douglas fir, white fir, cedar and spruce.

The present association was formed under the name of the Western Pine Shippers' Association, which was organized in 1903 with headquarters at Spokane, Washington. From 1907 it has continued under the present name.

The principal activities, in order of importance, are as follows:

(*a*) Grading and inspection.
(*b*) Statistical information.
(*c*) Traffic department.
(*d*) Box bureau.
(*e*) Legal department.

Hardwood Manufacturers' Institute, Chicago, Illinois.

The Hardwood Manufacturers' Institute has been one of the most active groups in promoting association activity and in assisting and protecting its members.

With the increased demand for hardwoods during the early part of the twentieth century, there were various and sporadic efforts to secure a strong central organization. In 1902, the Hardwood Manufacturers' Association of the United States was organized and for a long time had headquarters in Cincinnati. This organization was the result of dissatisfaction and disputes among the manufacturers over methods used by the National Hardwood Lumber Association in its grades and inspection service. The manufacturers adopted their own grading rules and established their own inspection service. In 1913, the Gum Manufacturers' Association was organized at Memphis, and in 1917 the oak manufacturers organized along the same lines as those followed by the gum manufacturers. The gum and oak associations were amalgamated late in 1917, to form the American Hardwood Manufacturers' Association with headquarters at Memphis. This new association followed the advertising program of former associations and developed statistical matter to assist its members.

As many members of this association were also members of the Hardwood Manufacturers' Association, they decided that all the manufac-

turers of hardwood could secure much better results with less expense and inconvenience by combining their efforts. This was done in 1918, and the name of the American Hardwood Manufacturers' Association was retained.

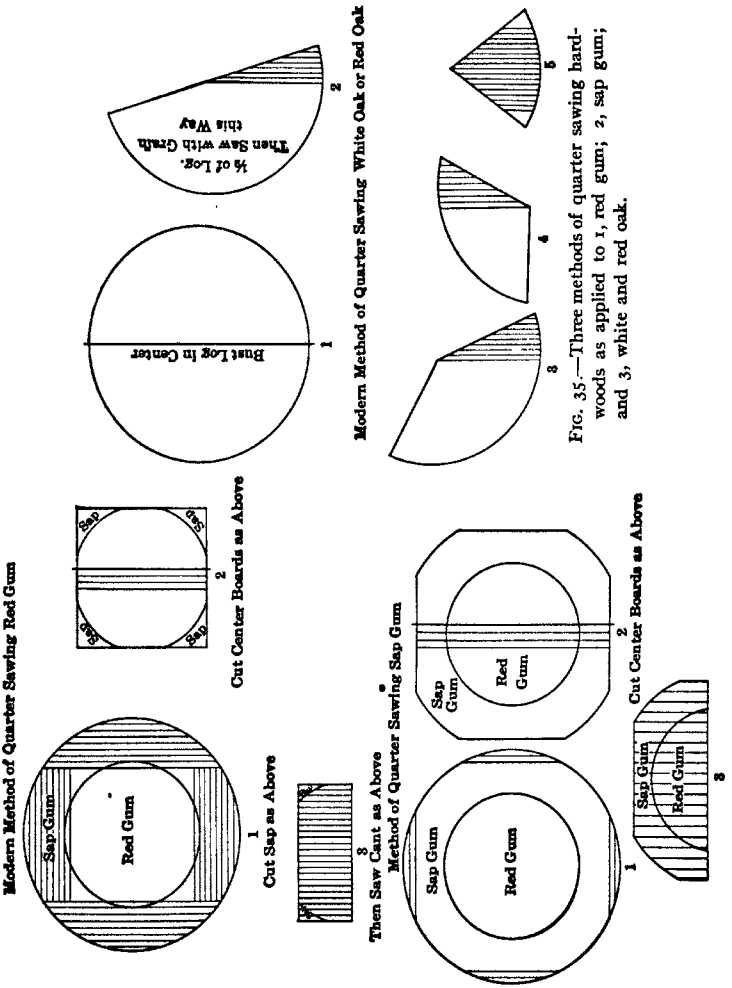


FIG. 35.—Three methods of quarter sawing hardwoods as applied to 1, red gum; 2, sap gum; and 3, white and red oak.

The new organization successfully took over the grading rules and inspection service of the Hardwood Manufacturers' Association, as well as its open price statistical service, maintaining this service until 1920 when the Government prevented the giving out of any information

regarding production or stocks on hand. The Supreme Court sustained this injunction and the statistical work was discontinued.

Realizing the need of a strong central association for the protection and promotion of the hardwood manufacturers, many of the leading hardwood producers in 1922 reorganized the association under the name of the Hardwood Manufacturers' Institute, membership in which is limited to *bona fide* hardwood lumber producers and the institute has pledged itself to support constructive policies and to help other producers and the general public alike.

California White and Sugar Pine Manufacturers Association, San Francisco, California.

This association was founded in 1916 and is composed of the principal manufacturers of California white pine (*Pinus ponderosa*), also called western yellow pine or western soft pine, and sugar pine (*Pinus lambertiana*).

There are 52 companies in this association, representing 54 mills, most of them in California and a few in Oregon. Although one of the smallest in membership, it has a relatively large production and has been very active and progressive.

The normal annual output of the mills of this association is about 850,000,000 board feet. This output varies considerably with the general market conditions. There is a long and continuous supply in sight for a great many years, as the mills are largely located in the heavy timber on the western slopes of the Sierra Nevada Mountains.

A very high grade of lumber is produced by this association. A great deal of it is used for finishing purposes throughout the United States in place of the eastern white pine, and more or less is exported to various countries.

The charge per thousand feet for the support of this association was started at 3 cents in 1916 and has been gradually increased. The present fee is 9 cents per thousand on actual production, together with 1 cent additional for traffic service, making a total of 10 cents per thousand board feet.

In addition to the two species mentioned above, more or less white fir, Douglas fir, red fir, and incense cedar are produced by the various mills.

California Redwood Association, San Francisco, California.

This is one of the most highly specialized of all the lumber manuacturers' associations. Its efforts are devoted to one species, with a few mills of large capacity and production. These mills are distributed in a comparatively small section of Northwestern California along a narrow strip contiguous to the Pacific Ocean.

This association was founded in February, 1916, and its principal object and outstanding accomplishment has been along the lines of trade extension.

There are 11 companies in the association, representing 13 mills which have a normal annual output of about 500,000,000 board feet of redwood, together with about 75,000,000 feet of Douglas fir.

Originally the area of redwood forest (*Sequoia sempervirens*) was in round numbers about 1,000,000 acres. It is now about 700,000 acres of virgin timber, with an estimated stand of 70,000,000,000 board feet. There are about 20 operating mills, and 70 per cent of the rated output of the redwood industry is represented in the redwood association. In 1922, six of the principal operating companies, retaining a professional forester, announced their intention of handling their entire properties on a sustained yield basis under a definite system of forest management. These six companies represent more than 50 per cent of the total redwood lands now in the hands of operating companies.

In round numbers, approximately 25 per cent of the annual output of redwood is marketed in the states east of the Sierra Nevada Mountains, 10 per cent goes to foreign markets, and the balance is distributed within the lumber markets of the State of California.

In 1921, the association's dues had advanced from 10 cents per thousand board feet, payable on domestic shipments, up to 25 cents per thousand board feet. They were then raised to 50 cents per thousand board feet.

The principal activities of the association, in order of importance, are the following:

(*a*) Trade extension.
(*b*) Statistical information.
(*c*) Traffic.
(*d*) Research.

Under the last heading, a comprehensive program of investigation has been initiated, in cooperation with the United States Forest Products

Laboratory at Madison, Wisconsin. This program includes a careful study of the wood-using industries and of the physical and mechanical properties of redwood, with a view to increasing the uses of redwood and utilizing mill and woods waste.

The Georgia-Florida Sawmill Association, Jacksonville, Florida.

This association was organized in 1899 among the operators of Georgia and Florida, to protect and advance the best interests of their members. At the present time it also includes several mills in Alabama. There are 150 lumber companies in the association, operating 150 mills, and the normal annual output is about 1,500,000,000 board feet.

The charges for the support of the association have been 7 cents per thousand board feet, which is an increase over previous assessments.

Practically all the mills in this association produce yellow pine, chiefly longleaf, with a limited quantity of shortleaf and similar quantities of loblolly. Shortleaf is sometimes called Rosemary pine in this section.

The chief activities of this association, in order of importance, are inspection, traffic and transportation, and the interchange of general information pertaining to the industry and its problems in this territory.

Yellow pine produced by the mills of this association is generally graded by the Interstate rules of 1905, which are used chiefly in the lumber markets of the North Atlantic Coast and differ considerably from those of the Southern Pine Association with headquarters at New Orleans.

The principal markets for the products of the mills of this association are in the Northeast, and considerable lumber is shipped by regular liners, schooners, and barges from such ports as Jacksonville, Savannah, Brunswick, Charleston, Fernandina, etc., to the North Atlantic ports.

Western Forestry and Conservation Association, Portland, Oregon.

One of the notable associations of timber owners is the Western Forestry and Conservation Association of Portland, Oregon, founded in 1909, and now embracing the various forest protective agencies in the three Pacific States of California, Oregon and Washington, as well as Idaho and Montana. The nucleus of this organization was the Washington Forest Fire Association and the four cooperative patrol associations in Northern Idaho, which in 1906 originated cooperative fire patrol in this country and later worked out an effective system of forest fire prevention with the United States Forest Service.

COMPARISON BETWEEN FINISH AND COMMON GRADES OF THE PRINCIPAL SOFTWOOD LUMBER. MANUFACTURERS' ASSOCIATIONS AND THE BASIC GRADES PROPOSED BY THE FOREST SERVICE. BASED ON DEFECTS PERMITTED IN EACH GRADE AS SHOWN IN PUBLISHED GRADING RULES

		Basic Grades proposed by the Forest Service	Northern Pine Manufacturer's Association	Western Pine Manufacturer's Association	California White & Sugar Pine Mfg's Association	West Coast Lumbermens' Association	Southern Pine Association	Georgia-Florida Sawmill Association	N. Carolina Pine Association	Southern Cypress Mfg's Association	California Redwood Association	Northern Hemlock and Hardwood Association	Mich. Hardwood Manufacturer's Association
SELECT GRADES	SUITABLE FOR NATURAL FINISHES	GRADE A Practically Free from all defects	FIRST CLEAR SECOND CLEAR THIRD CLEAR "A" SELECT	"B" SELECT AND BETTER	No. 1 AND 2 CLEAR	SELECTED FLAT GRAIN	"A" FINISHING	"A" FINISHING	No. 2 AND BETTER	CLEAR HEART AND "A"	CLEAR AND SAP CLEAR	INCH CLEAR AND SELECTS	"C" AND BETTER
		GRADE B Allows a few small defects or blemishes	"B" SELECT			No. 2 CLEAR	"B" FINISHING	"B" FINISHING		"B"	SELECT		
	SUITABLE FOR PAINT FINISHES	GRADE C Allows a limited number of small defects or blemishes that can be covered by Paint	"C" SELECT	"C" SELECT	"C" SELECT	No. 3 CLEAR	SELECT COMMON FINISHING	"C" FINISHING		"C"	STANDARD		
		GRADE D Allows any number of defects or blemishes which do not detract from a Finish appearance especially when Painted	"D" SELECT D STOCK AND BOX	"D" SELECT	"D" SELECT	*SELECT COMMON	No. 1 COMMON	No. 1 COMMON	No. 3	"D"	EXTRA MERCHANTABLE	INCH "D" STOCK	No. 1 COMMON
COMMON GRADES	SUITABLE FOR USE WITHOUT WASTE	No. 1 COMMON Sound and tight knotted stock. Size of defects and blemishes limited; may be considered water tight Lumber	No. 1 COMMON	No. 1 COMMON *	No. 1 COMMON	No. 1 COMMON				No. 1 COMMON		INCH No. 1 COMMON	
		No. 2 COMMON Allows large and coarse defects; may be considered grain-tight Lumber	No. 2 COMMON	No. 2 COMMON	No. 2 COMMON	No. 2 COMMON	No. 2 COMMON	No. 2 COMMON	No. 1 BOX	No. 2 COMMON	CONSTRUCTION		No. 2 COMMON
	PERMITTING SOME WASTE IN USE	No. 3 COMMON Allows large & coarser defects than No. 2 and occasional knot holes; 75% as good as *2 common	No. 3 COMMON	No. 3 COMMON	No. 3	No. 3 COMMON	No. 3 COMMON	No. 3 COMMON	No. 2 BOX	No. 3 COMMON		INCH No. 2 COMMON	No. 3 COMMON
		No. 4 COMMON Low quality Lumber containing the coarsest defects such as rot and holes. 50% as good as *2 common	No. 4 COMMON	No. 4 COMMON	No. 4 COMMON				RED HEART AND BARK STRIPS	BOX AND "PECKY" CYPRESS	**No. 3	INCH No. 3 COMMON	No. 4 COMMON
		No. 5 COMMON must hold together under ordinary handling	No. 5 COMMON	No. 5 COMMON	No. 5 COMMON	** CULLS	No. 4 COMMON	No. 4 COMMON				INCH No. 4 COMMON	No. 5 COMMON

* Usually included with No. 1 Common

** Local grade not recognized by the Association

ASSOCIATIONS

This organization recognized the desirability of protecting standing forests from fire, and in this way has contributed very effectively toward the permanence of forest industries and the cause of forestry in the Northwest.

This organization embraces 26 forest owners' organizations, a number of cooperative patrols without formal organization, and the various State and National fire protective systems in the five states involved. Within this organization there are 18,000,000 acres of private timber land, and fire protection covers about 35,000,000 acres, insuring natural reforestation on most of the area. The efforts of the association are directed toward joint work in forest economics generally, public and private work in research, public education, and the purchase of equipment.

This association has not only protected the standing timber for its various constituent members, but has been a very effective means of stabilizing industries in the great source of remaining timber supplies in the nation.

National Lumber Manufacturers' Association.

This organization is made up of the following regional manufacturers' associations: The Southern Pine Association; The West Coast Lumbermen's Association; The Redwood Manufacturers' Association; The Western Pine Manufacturers' Association; The California White Pine and Sugar Manufacturers' Association; The North Carolina Pine Association; The Georgia-Florida Sawmill Association; The Hardwood Manufacturers' Institute; The Southern Cypress Manufacturers' Association; The Northern Hemlock and Hardwood Manufacturers' Association; The Michigan Hardwood Manufacturers' Association; The Northern Pine Association; and the Western Forestry and Conservation Association.

This strong central organization has headquarters in Washington, D. C., with branch offices in Chicago, Ill. Its officers have recently brought the association into a position of great prominence and influence among America's outstanding industries.

Its members produce about 70 per cent of all of the lumber produced in this country. Within recent years, the assessment against subscribing associations has been from $\frac{3}{4}$ of a cent to 2 cents per thousand board feet.

The efforts of this organization are exerted largely along the following lines:

1. Collection and dissemination of statistics of a national character.
2. Adjustment of railroad transportation problems.
3. Formation of uniform basis of credits and collections.
4. Formation and encouragement of interstate organizations for the benefit of members.
5. Trade extension measures designed to increase the use of wood.
6. Formation of a national forest policy as representing the ideas and interests of the industry.
7. Architectural and building code service.
8. Maintenance of the best governmental relations.
9. Forest utilization to increase the better and more complete use of the raw products of the forest.

National-American Wholesale Lumber Association.

This organization is a merger of the two important wholesale lumber associations, both national in their scope, which were amalgamated at a joint convention at Pittsburgh in March, 1923.

The membership comprises all former members in good standing of the National Wholesale Lumber Dealers' Association, which was founded in 1893, and had headquarters in New York City, or of the American Wholesale Lumber Association, with headquarters in Chicago, organized in 1920.

The "National-American" is now the only national spokesman for the wholesale lumber industry. While manufacturers are admitted to full membership in the Association, the by-laws provide for the maintenance of the membership on the basis of 60 per cent wholesalers, thereby placing in the hands of wholesalers the domination of association policies. The objects of the association are to protect the interests of its members, to enhance the standing and reputation of the wholesale branch of the lumber industry, to aid in the more efficient distribution of lumber and forest products, and to cooperate with all branches of the industry in constructive programs for the advancement of the industry. In addition, the association maintains active departments bearing on the everyday problems of the members.

The best tenets and principles of both former associations have been preserved under the new organization. It represents a combined membership of about 700 firms, is national in scope, and is truly representative of the lumber industry, offices being maintained in New York City and Chicago.

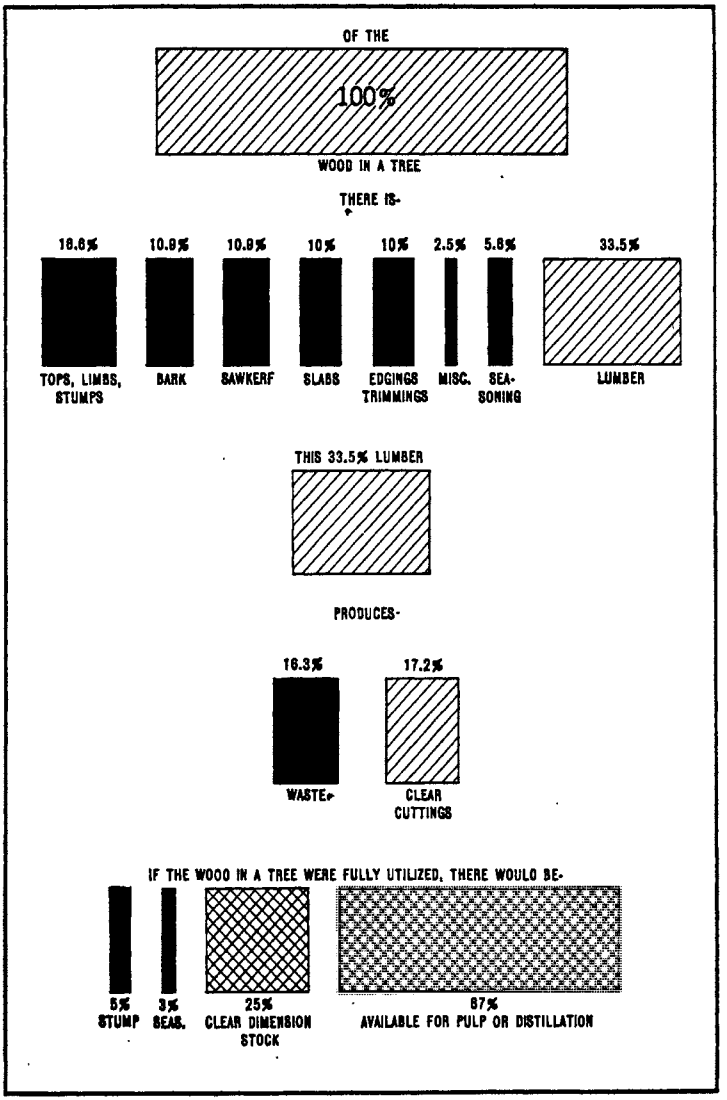


FIG. 36.—Chart showing the approximate loss of wood in logging and manufacturing American lumber. It is based upon trees actually felled in all the forest regions of the country. (Courtesy of The National Association of Wood Turners.)

The following are the principal direct membership privileges:

1. Compulsory artibration, covering disputes between members of the association and members of other recognized trade associations.
2. Credit service.
3. Collection department.
4. Traffic service.

As a result of the amalgamation of two strong organizations, the present organization is much better equipped to render higher standards of service to its members. This has become a very representative organization and has helped to put the wholesale branch of the industry on a much higher basis than ever before.

West Coast Forest Products Bureau.

The West Coast Forest Products Bureau, a joint activity of all the branches of the West Coast lumber industry—timber owners, loggers, manufacturers and wholesalers—was organized in 1920 for the purpose of making information regarding West Coast woods available in marketing territory and of improving production and marketing conditions.

Its principal activities include the following:

1. Surveys of present and prospective markets to determine present requirements and new opportunities.
2. Studies and reports on opportunities offered as developed by the surveys.
3. Local surveys to determine present products most suitable to exploitation, changes desirable in present methods of production to reach new markets, and requirements of new markets desirable to develop.
4. Writing of articles for publication in popular, trade and technical publications.
5. Talks before trade and professional associations.
6. Exhibits.
7. Publications on properties and uses of West Coast woods.
8. Advertising.
9. Technical research.

On account of the distance of the West Coast from the greater part of the market territory, the lack of detailed knowledge of West Coast woods in the East, and the difference between West Coast woods and grades and those with which they come into comparison—largely due to the great size to which the West Coast timber grows—it was felt that personal representation and contact was the first essential.

The principal activity of the Bureau has, therefore, been in maintaining field men in the eastern territory, who have been putting information regarding West Coast woods before lumbermen, architects, engineers, technical schools, contractors, railroads, and the various industrial users of lumber.

National Retail Lumber Dealers' Association, Chicago, Illinois.

This association was organized as a national body in Chicago on September 18, 1916. It has a membership of over 6000, as well as 12 state and insterstate retail lumber dealers' associations and their constituent members. A fundamental tenet of this association is that the retail lumber dealer is an economic necessity to the industry and to society, and the slogan is " maximum distribution of lumber and other building materials through the local retail lumber yard."

The association issues a monthly magazine, entitled *The Retail Lumber Dealer*, with a circulation of over 16,000. This is published at headquarters in Chicago, and discusses questions of vital interest to the retail lumber industry. By this means members are kept informed regarding railroad traffic conditions and car supply. Valuable statistical matter is published in a weekly traffic letter issued from headquarters and a retail lumber market letter, giving the business outlook, group condition, and similar information gathered from members in all parts of the country, is issued semi-monthly to members.

This is one of the most influential and progressive of the national organizations in this country, and its secretary-manager has elevated it to a position of great prominence in the industry. It has been particularly active during and since the war, and has its present headquarters in Chicago. Its original purpose was to provide a national review for the retail lumber industry of the country; it has rendered very efficient service in connection with embargoes on lumber shipments, in the handling of transit cars and reconsignments, and, in cooperation with the manufacturers, in bringing about a better understanding of the problems of the retail yard trade.

It conducts a traffic and transportation department at Washington, D. C.

Empire State Forest Products Association, Albany, N. Y.

This association was first organized in 1906, under the name of The Adirondack Lumber Manufacturers' and Shippers' Association. In 1909 the name was changed to that of Empire State Forest Products

Association, since it had expanded its activities to include all forest industries and water power as well, and from being purely an Adirondack Association had become state-wide.

The objects of the Empire State Forest Products Association are as follows:

"To protect, perpetuate and increase the forest growth of the State through the establishment of a rational and constructive system of forestry; the conservation and development of water power in the State of New York and to promote friendly intercourse between the members, and to cooperate with others interested in like objects."

The most important activities of the association are educational, rather than commercial. It does not concern itself with grading, standardization of products, or exchange of trade information. It devotes itself rather to the dissemination of scientific and statistical information which is broadly useful to all timberland owners and operators in the State of New York; to assisting owners and operators in their problems, such as forest fire prevention, forest utilization, and the like; to cooperating with existing agencies of the State and Federal Governments in bringing about better conditions for forestry in the State; and to a systematic following of legislation which may be introduced, in order that harmful measures may be prevented, and useful, constructive measures passed.

To this end the association maintains a quarterly bulletin and issues frequent circular letters and forestry and water-power leaflets, and in general acts as the representative of the forest industries and timberland owners of the State of New York.

TRADE JOURNALS

History.

For the past fifty years there has been a notable development and improvement in publications devoted to various lines of business and professional activities. The trade journal idea has been developed to a greater extent in the United States than in any other country, and such journals have no doubt played an extremely important part in the development of the various phases of American industry.

In the lumber industry, the trade journals have developed usually in a definite region, and in some cases have expanded to national importance and interest. At the present time the lumber trade journals are devoted to one, two, or three of the great branches of the lumber business, depending upon their location and function.

Function and Influence on the Industry.

The American lumber trade journals have had a very positive and stimulating influence upon the development and progress of the lumber industry. They have fulfilled an exceedingly important function in molding and formulating opinion within the various branches of the industry. They had been the media of advertising and the means of bringing the attention of buyers to the merits of the services offered by the various mills, groups of mills, wholesalers and retailers. Most of the lumber trade journals, however, have been devoted to the interests of the manufacturing end of the business, particularly those located in the great centers of production. They have contributed in a very important way toward protecting the industry against unfair practices and against publicity which has been injurious to the lumber trade. They make available to their subscribers, moreover, the latest developments and progressive movements in the manufacturing, wholesaling and retailing ends of the business, giving new ideas for the improvement of merchandising as well as manufacturing methods. They have also taken an active part in the formulation of a new forest policy, the standardization of lumber grades and sizes and other matters of national importance not only to the industry but to the American public at large.

Principal Journals.

The following are some of the principal lumber trade journals issued in this country, with a brief statement of the history, development and policy of each.

The American Lumberman, Chicago.

The American Lumberman is the oldest and largest trade newspaper in the United States, and was founded in 1873 at Muskegon, Michigan. It is a truly national publication, covering every branch of the lumber industry. *The American Lumberman* specializes in matters tending to make the lumbermen of the country better merchandisers; this applies to manufacturers as well as to wholesalers and dealers. This publication does not represent any special phase of the industry, but endeavors to cover all phases, including timber ownership. It first appeared under the name of *The Michigan Lumberman and Railway Journal.* It moved later to Chicago, where it was issued under the name of *The Northwest Lumberman*; and in 1899 it was consolidated with *The Timberman,* a

growing and successful publication that had been founded earlier by James E. Defebaugh. The present name, *The American Lumberman*, was assumed on the consolidation of the two former journals. It is widely read and used by men engaged in all branches of the lumber industry, both in this country and in all foreign countries where lumber is manufactured and sold.

The Southern Lumberman, Nashville.

The Southern Lumberman is the oldest lumber paper in the United States appearing continuously under the same name, the first issues having been printed in 1881. Moreover, it claims the unique distinction of being the only lumber trade journal founded by a man who actually ran both a paper and a sawmill.

The founder of *The Southern Lumberman* was operating a small sawmill near Nashville and was very much impressed with the fact that at that time very little attention was given in the press to the timber resources and the manufacture of lumber in the South. The primary field occupied by this paper is the southern lumber industry. The publication at once drew marked attention and now covers a wide field, being devoted primarily to the interests of the lumbermen of the South. It is published weekly and has made a specialty of running stock lists of concerns, a practice which has given it a wide standing throughout the lumber trade in the South, East, and Middle West.

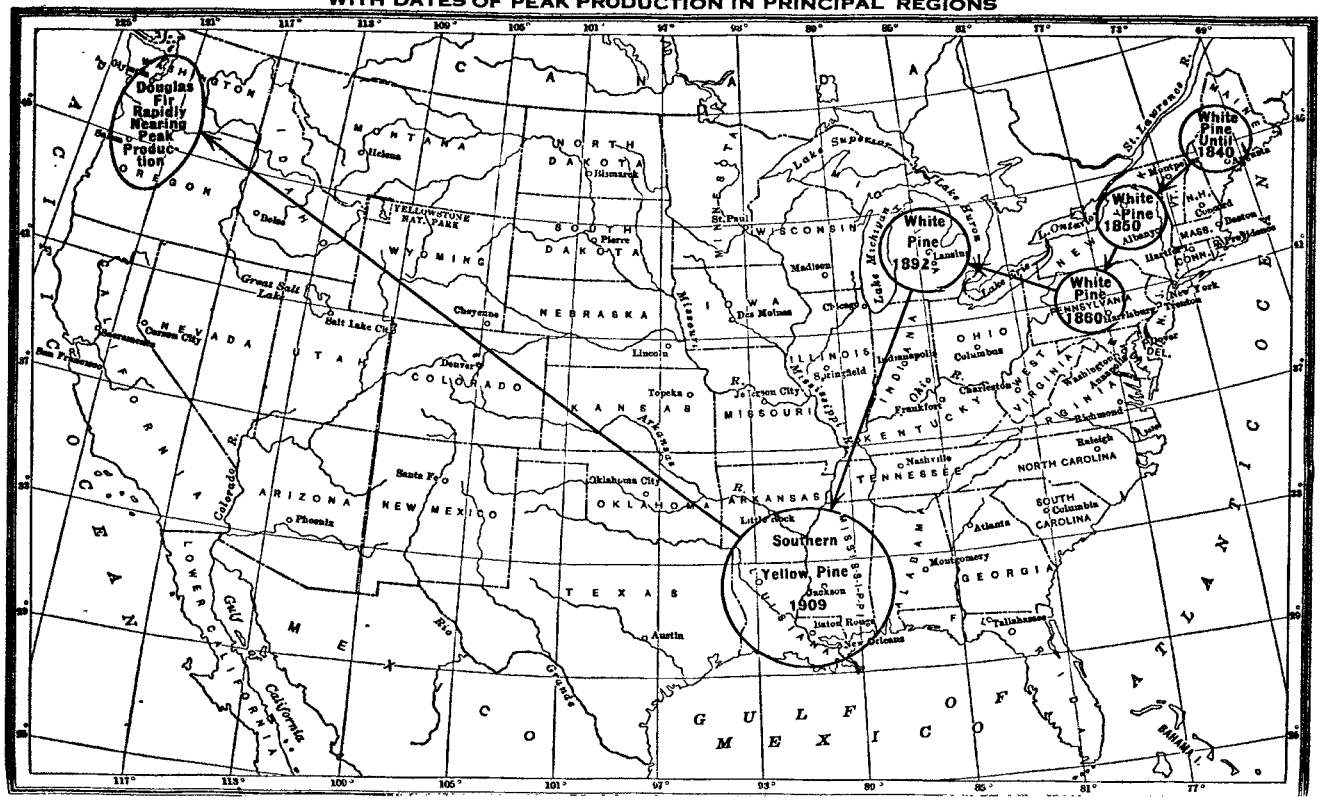
Lumber World Review, Chicago.

This trade journal is one of the most progressive and active of the lumber trade publications and is the result of a combination, in 1912, of the *Lumber Review*, founded in 1897, and the *Lumber World*, founded in 1905. Its policy has consistently been to combat the exploitation and continued use of so-called lumber substitutes, to further the development of new uses for woods, efficient manufacturing and merchandising methods, the development of a national forest policy, and the future of the industry. The editor's opinions, as expressed through its editorial page, entitled "Wide East Window," have won a very large following and have reflected the progressive ideas of the industry, particularly those affecting standardization of lumber sizes and nomenclature, railway transportation problems, and a forestry policy for the country at large.

MAP SHOWING

PROGRESS OF LUMBER INDUSTRY

WITH DATES OF PEAK PRODUCTION IN PRINCIPAL REGIONS



The Timberman, Portland, Oregon.

This publication is issued monthly at Portland, Oregon, and was established in 1899. It is one of the largest lumber trade journals in this country. It is somewhat unique in this field, resembling a lumber magazine rather than a trade newspaper, and is particularly well known for its efforts in creating "logging literature." In 1909, the editor of this publication founded the Pacific Logging Congress, which meets annually for the purpose of reviewing the year's progress in logging. He has cooperated in establishing courses in logging and engineering at many of the western universities.

The Timberman has also been very active in organizing the woodworking industries of the West and in fostering a spirit of cooperation as between the producer and the consumer of mill work and other products of the lumber industry, as well as in the lumber trade itself.

Although the field of *The Timberman* is largely in the region west of the Rockies, it enjoys a wide circulation throughout the United States and Canada and in many foreign countries. It has been very actively in favor of forest fire protection and reforestation, looking to the perpetuation of the lumber industry. Its progressive spirit has been most exemplary in this respect.

Hardwood Record, Chicago.

This is the only lumber trade journal devoted exclusively to the hardwood industry in its editorial and advertising departments. It was founded in 1895 and was published as the *Chicago Hardwood Record* until 1902, when the name was changed to the *Hardwood Record.* A new organization, called the Hardwood Company, took over the publication in 1905 and the title from that time has been *Hardwood Record.*

The scope of the *Hardwood Record* is limited only by the extent of the industries consuming hardwood lumber and veneers, the hardwood sawmills and wholesale industries, and the veneer manufacturing and small hardwood industries. It is essentially an executives' publication, the purpose being not strictly to serve as a newspaper made up of news facts within the industry, but to give all of the important current news developments in a condensed form. It serves as a sort of forum—a common meeting ground between the seller and the buyer of hardwood lumber and veneers. It has a wide circulation, not only in the lumber and woodworking companies, but also among the furniture, interior finish, store

and office fixture, musical instrument, automobile, show case and automobile body industries.

West Coast Lumberman, Seattle.

This is the oldest lumber trade journal in the West, having been established in 1889. In 1913 the *West Coast Lumberman* was merged with the *Pacific Lumber Trade Journal* of Seattle, which had been established in 1895. Prior to the amalgamation of these magazines, both were monthly journals, but since 1913 the paper has been issued as a semi-monthly publication. It has always been the policy of this journal to publish all the news of interest in the Pacific Coast and Northwest States, and to present certain facts not only to the lumbermen themselves but to the public generally. It has also been a part of the policy to obtain and publish as many special articles as possible, bearing upon the problems arising from time to time in the lumber industry.

The province of the *West Coast Lumberman* has been that of a news journal and that of a lumber magazine as well. It has been very successful in presenting to its readers detailed information regarding prices and market conditions, believing that the lumber and shingle manufacturers, as well as the wholesale and retail lumbermen, are primarily interested in the prices at which they can sell their products.

New York Lumber Trade Journal, New York City.

This periodical was founded in 1886 as a semi-monthly journal to give to the East a representative lumber trade paper of interest to the retailer and wholesaler as well as the manufacturer. It has continued as a semi-monthly publication since this time. It was first published by practical lumbermen, a circumstance which insured its success from the start, and has been continued under very able management ever since. Its principal province is to provide a medium for the distribution of reliable and accurate information regarding the lumber markets of the East and the affairs of the lumber industry in general. One of its special features is the giving of the current wholesale prices of the principal kinds of lumber sold in the eastern markets. It has a wide circulation, particularly in the East, and also throughout the country and in several foreign markets.

It has had a notable success in introducing new woods to the eastern markets.

The Lumber Trade Journal, New Orleans.

The Lumber Trade Journal was founded in 1881 in Chicago, where it was published for a number of years as a monthly paper. In 1894 its publishers, realizing the fact that the South was rapidly attaining a position of importance in the lumber-producing field, removed its office to New Orleans, where it has remained ever since. Shortly after the removal, it became a semi-monthly paper.

The policy which has always guided *The Lumber Trade Journal* is based upon the thought that it is the function of a trade paper, first of all, to give the news relating to the industry and those engaged in it, not only in a broad way, but more especially as regards its own immediate territory. It has been its aim to establish and maintain a close and intimate contact with its readers, based upon a recognition of their mutual interests, and to deserve their confidence in it as an accurate and reliable disseminator of news.

It has been the consistent policy of *The Lumber Trade Journal* to actively cooperate with the lumber organizations, not only by giving the greatest possible publicity to their activities, but by lending such aid as it could in the formulation of their policies and methods. In such matters as legislation and the relations of the industry with Governmental agencies, it has been diligent in keeping its readers advised in the way of news. In addition, it has made it a point to supplement the recital with analysis and comment designed to assist the reader to an intelligent understanding of the situation and its effect upon the lumber industry.

FEDERAL GOVERNMENT

United States Forest Service.

This organization is the most important agency for the promotion of and research in forestry in the country. It manages the National Forests, which comprise about 157,000,000 acres, or one-sixth of the forest area of the country, included within which is found one-fifth of the remaining standing saw timber. The National Forests are located in twenty-six states, chiefly in the West, with a few in New Hampshire, Pennsylvania, the Southern Appalachians, Florida, Arkansas, Michigan, and Minnesota.

The amount of lumber placed annually on the markets of the country from the National Forests amounts to only about 3 per cent of the total

consumption of the United States. This proportion, however, will be gradually increased in the future.

The Forest Service receives over $5,000,000 annually from the sale of its products and privileges, chief of which are timber, from which it receives revenue of about $2,000,000. From the sale of grazing rights it receives about $3,000,000, and the small balance is received from the leasing of water-power sites and other privileges.

The Forest Service cooperates with private owners of timber land in a very important way throughout the West, particularly in fire protection and to a limited extent in insect control. In 1921, it cooperated with 927 timber holders in protection from fire. It works in very close cooperation with the private timber owners of the Northwest through the Western Forestry and Conservation Association, in the protection of both private and Government timber lands.

In 1922 in cooperation with the forest departments of twenty-six states, it protected, jointly, 166,000,000 acres. Private owners of timber lands now spend annually about $1,000,000 for fire protection on their timber holdings.

The Forest products Laboratory at Madison, Wis., has been of great assistance to the American lumber industry in its efforts to acquire a better knowledge of lumber as a material, its methods of seasoning and utilization. The chief forester, in his report for 1920, estimated that the investigations of the Forest Products Laboratory in ten years had cost about $2,000,000, and that the results of its investigations were a saving of at least $30,000,000 annually to the lumber industry. The Laboratory has been very active in the standardization movement, in recommendations for railroad tie and timber specifications and in making tests and investigations in wood preservation, pulp and paper making, strength and other properties of timber, the kiln-drying of lumber, box construction, utilization of waste, plywood construction, and in many other similar and related fields.

Publications of the Laboratory and of the Forest Service in general have been of incalculable assistance to the lumber industry.

Bureau of Foreign and Domestic Commerce.

The lumber division of this bureau is one of fifteen commodity divisions and has been of great assistance to the lumber industry in compiling information regarding the export markets and methods, and in assembling material of interest and value to various enterprises within or con-

nected with the industry throughout the country. It serves as the connecting link between the domestic industry and the many agencies of the bureau located in important markets and centers throughout the world.

The division of building and housing, in the same bureau, has been of considerable service in compiling statistics and information regarding the prices of building materials, zoning regulations, etc.

Miscellaneous.

Other Government organizations which work in close touch with the lumber industry are the Bureau of the Census, which annually compiles statistics of lumber production; the Bureau of Entomology, which makes a study of insects injurious to forest products; the War and Navy Departments, which have important lumber purchasing offices; the National Park Service, which controls and operates an extensive system of National Parks containing large timber lands, chiefly in the west; the Bureau of Plant Industry, which conducts investigations of the diseases of forest trees and of fungi and other organisms which attack lumber, piling, and many forms of forest products; the Division of Simplified Practice in the Department of Commerce, which has been of great assistance in the standardization and simplification of lumber grades and sizes; the Bureau of Labor Statistics, which compiles information regarding labor statistics and wholesale prices; the Forest Products Section of the United States Tariff Commission, which keeps in constant and close touch with the lumber industry; the National Forest Reservation Commission, which has made important purchases of new areas for National Forests; the Timber Valuation Section of the Treasury Department, which determines proper timber valuations for Federal tax purposes; the Interstate Commerce Commission, which regulates freight traiffs, acts on claims cases and publishes valuable statistics; and the Federal Trade Commission, under which the Webb-Pomerene export trade act is operated, and which cooperates with the Department of Justice in its investigations of the lumber industry.

CHAPTER XV

SUBSTITUTES [1]

REASONS FOR INTRODUCTION

THE question of the introduction and constantly increasing use of lumber substitutes has been an important one since about the year 1910. Shortly thereafter the question of substitutes was widely discussed throughout the industry. An important result has been the discussion and adoption of more active advertising and trade extension among the three great branches of the industry, but particularly among the manufacturers, both individually, by groups, and through associations.

With the growing scarcity of virgin stumpage in this country and, the concomitant rise in lumber values, it is only natural that when prices of certain grades rise to high levels, other materials with which wood naturally competes for construction purposes will be introduced and used. If the costs are approximately on the same level, the ultimate consumer must decide between two or three materials.

The following is a summary of the chief reasons for the introduction of lumber substitutes.

1. The rising costs of lumber. This is obviously the greatest single reason for the introduction and use of substitutes. Furthermore, considerable propaganda has been spread broadcast to the effect that, with the growing scarcity of our forests, lumber prices have risen to enormous heights. The effect of such a belief on builders of homes and users of lumber, has no doubt been the greatest single factor in the increasing interest in the use of substitute material.

2. The activity of manufacturers of steel, concrete, iron, cement, brick, patent roofing and covering materials, wall boards, paper board containers, patented partition stock, and many others which could be mentioned. These manufacturers have no doubt convinced some of the public that lumber is becoming so scarce that its future use will be greatly curtailed on account of expense.

[1] For an extended discussion of this subject, see The Substitution of Other Materials for Wood, by Rolf Thelan, Report No. 117, U. S. Dept. Agr., 1917.

3. The campaign against the use of inflammable materials for construction purposes. The annual damage caused by fires in this country is stupendous as compared with the loss suffered by other civilized nations; and as wood is probably our most common construction material and is subject to burning, the manufacturers and distributors of substitute materials have exerted every possible influence in discriminating against all forms of wooden construction. Many tests are being made and processes are being devised to fireproof wood. Redwood is a very slow-burning material. The fact that San Francisco was largely constructed of this wood, accounts for the comparatively slight loss of life and property after the great earthquake and fire of 1906.

4. Building Codes. With the tendency toward rapid urban growth, many cities have revised their building codes to prevent the use of wood within certain limits. This naturally has militated against the use of lumber. The demand for fireproof buildings in the centers of our great cities is a wise move toward betterment of conditions and has not been opposed by sensible and progressive lumbermen; but in many cases building codes have improperly discriminated against the use of wood in certain districts. In many municipalities disputes are now in progress because of this prejudice against wood.

PRINCIPAL KINDS

Aside from the specific substitutes mentioned above, concrete poles and posts are replacing wooden forms, particularly along railways, which are great users of both of these materials, as well as on power transmission lines, etc.

About 10 per cent or more of our total lumber production is used for boxes, crating, and similar containers. The extended use of fiber boards and paper boxes has made considerable inroads into the box industry, but recently there has been a return to the use of the wooden boxes, particularly since certain improvements in the latter were demonstrated by the United States Forest Service Laboratory at Madison, Wisconsin. The heavy damage claims resulting from the use of substitute materials by the railroads have also encouraged the use of wooden boxes.

Many worn-out wooden platforms, walks, piers, docks, bridges, and jetties have been replaced by substitute materials.

As a result of the increasing frequency of accidents on our railways, there has been a movement to replace all wooden cars bought for passenger and freight service with steel cars. In spite of this widespread

campaign, which has resulted in the use of many steel cars, statistics show that with the demand for increased traffic on our common carriers more wood is used in the construction of cars on our American railways than ever before.

Many attempts have been made to replace the wooden cross ties with steel, iron, concrete, or composition ties, but without success. In spite of the increased prices demanded for cross ties, this country still continues to use from 100,000,000 to 140,000,000 every year.

INFLUENCE AND EFFECT UPON LUMBER INDUSTRY

Although a great deal has been written and said about the lumber substitute question, both within the lumber industry and within the lumber trade journals, as well as among those interested in promoting the manufacture and use of substitutes, the introduction of these materials has not had any great effect on the industry up to the present time. New demands have been made upon our forests, through the adoption of wood-block paving, and the use of wood in all concrete, cement, steel, and iron construction; and the demand for wood for wood pulp and general construction purposes has continued.

There is no doubt that construction in this country will eventually follow, more or less closely, the lines laid down centuries ago in Europe, where wooden construction materials are exceedingly scarce and expensive. There, all exterior parts of both urban and suburban homes are of stone, brick, stucco, or other substitute materials. This practice is based upon economic necessity and is not due to any prejudice against the use of wood. Furthermore, Europeans generally build homes and structures intended to last one hundred years or more, whereas in this country there has been a distinct tendency to build wooden homes on the outskirts of our largest cities as well as in our smaller cities and villages.

The future course will no doubt be determined by economic necessity. The per capita consumption of wood gradually falls off with the rise in cost of wood supplies, and the rapidity of this falling off will be in direct proportion to the rapidity in the rise of values of lumber and other forest products.

However, in no civilization is it possible to eliminate entirely the use of wood. Even in Europe, where the substitute idea is carried to the extreme, large quantities of lumber are imported at great expense and used for doors, floors, casings, window sash, and interior trim, as well as

for boxes and crating stock, car construction, furniture, and many other purposes for which wood has been demonstrated to be the best material. It seems an anomalous condition that in Europe, where wood is scarce and expensive, all the railways continue to use and operate wooden coaches, while in this country, where lumber is comparatively cheap and plentiful, there has been a great popular cry in favor of the introduction and use of steel coaches.

The following table, compiled by the Department of Commerce, shows the volume of construction with the three principal building materials for four years, each index number being based on 1913 activity as 100.

	1919.	1920.	1921.	1922.
Lumber production	94	94	80	103
Cement production	87	109	107	124
Fabricated steel sales	125	130	87	168


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